HE RAIL JOINT COMPANY, Inc.
CHURCH ST. NEW YORK, N. Y.

Reliance **HY-CROME** *Spring Washers*

HY-PRESSURE HY-CROME

DOUBLE HY-CROME

HY-CROME BOLT SECURITY

LOCOMOTIVE HY-CROME

HY-CROME *Springlocks*
Patent Applied For

A bolt under proper tension is not loose—because of various conditions wear and looseness are inevitable—automatic compensation for wear and looseness is the only way to maintain proper bolt tension.

RELIANCE HY-CROME Spring Washers have been scientifically developed, meeting requirements of varying bolt assemblies. Through research and laboratory investigation the serviceability of HY-CROME Spring Washers is predetermined.

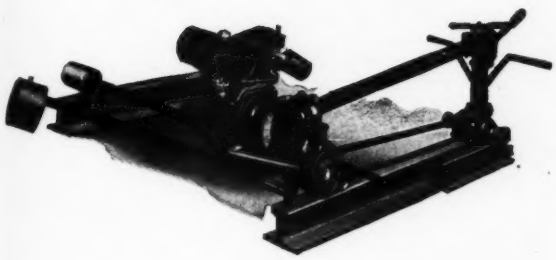
Best wishes for a successful convention to the members of the Roadmasters' and Maintenance of Way Association of America

EATON MANUFACTURING CO. RELIANCE SPRING WASHER DIVISION, MASSILLON, OHIO

Sales Offices: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

Raco Power Track Machine



Light, strong, easily handled.

The choice of **50 roads,** including the largest systems, Raco has to have **obvious superiority.**

The original design of the Raco has proved so satisfactory that no major change has been necessary. Parts furnished to-day are interchangeable with all machines in service.

The Raco delivers an exactly uniform power to every nut. The slip clutch is the most reliable known means to accomplish this.

The **most mobile** machine is the **fastest** machine. On out-of-face tightening, **over the long stretches,** the Raco proves its **speed and economy.**

Raco Tie Boring Machine

Bores holes for **screw** spikes or **cut** spikes.

Bores ties in track more than **twice as fast** as any other accepted means.

Bores holes **absolutely vertical.**

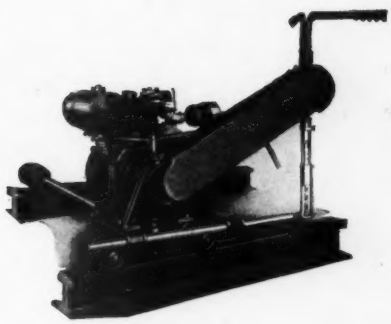
Locates all holes **exactly in center** of tie plate punching.

Automatically **controls depth** of hole.

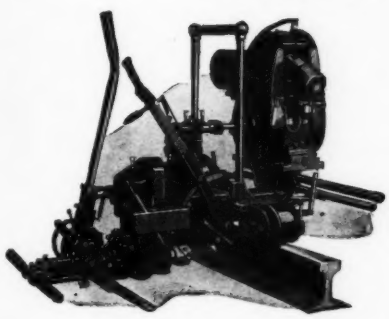
Chips are blown away as fast as made, leaving hole clear.

One-man operation.

Machine can be removed from track by one man.



Everett Power M-W Machine



For ten years the Everett M-W has been the **standard** power rail drill on practically all railroads.

Its design and construction insure the utmost in facility of operation and in speed and accuracy of adjustment.

It has made such astonishing records for economy that **no road can afford to use any other means for drilling bolt holes.**

RAILROAD ACCESSORIES CORPORATION

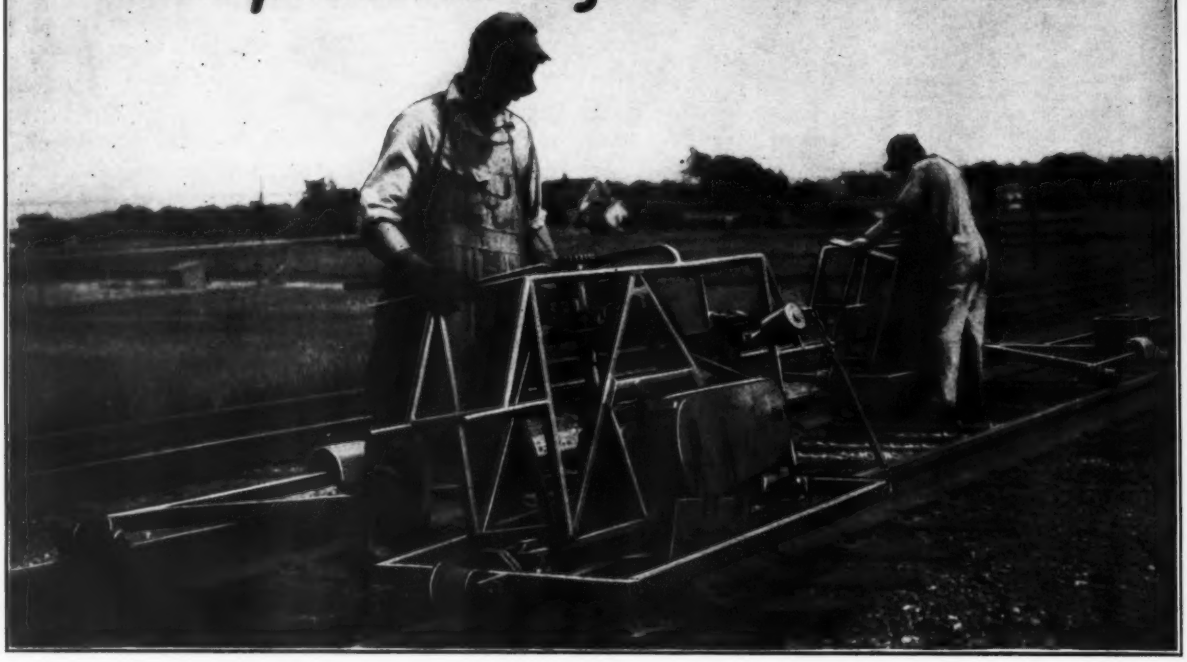
MAIN OFFICE

405 LEXINGTON AVENUE

(Chrysler Building)

NEW YORK

Take the jar and jolt out of joints with precision ground rail ends



Two Nordberg Precision Grinders grinding about 70 miles of hardened rail ends.

In addition to such grinding applications as surfacing welded rail ends, removing mill tolerance and equalizing the height of cropped rail, a recent application of the Nordberg Precision Grinder was that of removing the humps at hardened rail ends. Some of the rail had been in service for nine years and humps had developed because of less wear of the harder metal. In some instances, these were seventy thousandths of an inch higher than the body of the rail. Removing these humps relieved the joints of that terrific pounding of heavy traffic at high speed, greatly reducing the expense of maintaining joints—one of the largest items in the cost of track maintenance. Smoothing out the humps gave better riding track and saved on wear and tear of equipment. For such a rail grinding application, the Nordberg Precision Grinder gives an accuracy of ground surface which can not be approached by any machine used for a similar service. For other grinding jobs on rail, switches and crossings, there are three other Nordberg Grinders just as outstanding in performance.

NORDBERG POWER TOOLS FOR TRACK MAINTENANCE

Precision Grinder
Utility Grinder
Adzing Machine
Track Wrench
Surface Grinder
Rail Drill
Spike Puller
Power Jack
Track Shifter

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

Export Representative—WONHAM Inc.—44 Whitehall St., New York

PROTECT YOUR STEEL WORK AT ONE-HALF THE COST!

Save the Cost of thorough cleaning

NO-OX-ID PENETRATES OLD RUST AND PAINT

It's expensive to clean off every bit of rust before painting steelwork. NO-OX-ID saves this expense because it protects steel even when it is applied over rusted areas.

When using NO-OX-ID, all you need to do is scrape off the loose rust patches. Then brush a coat of NO-OX-ID "A Special" over the remaining rust and old paint. NO-OX-ID will penetrate to the metal, stop further corrosion, and loosen old rust scale. As the old scale falls off, touch up with NO-OX-ID. From one to three years later, apply a finishing coat of NO-OX-ID Filler to give lasting protection. Paint over if you desire. NO-OX-ID stops the loss of metal!

NO-OX-ID acts mechanically, to exclude moisture and oxygen from the surface; and chemically, to inhibit corrosion under the film.

Also Protects Water Tanks, Pipe Lines, and Signal Equipment

The use of NO-OX-ID is not limited to bridge structures. It prevents corrosion on all steelwork.

It is easy to protect your bridge structures against corrosion by using NO-OX-ID. Because of its penetrating power, it can be applied over adhering rust and paint.

NO-OX-ID PROVIDES MECHANICAL AND CHECHEMICAL PROTECTION

Ordinary coatings which dry by oxidation are permeable and do not keep out all moisture. Furthermore, they do not adhere to rusted areas over which they may be painted, but crack as they dry and admit moisture. As a result, corrosion progresses rapidly under the coating.

NO-OX-ID has a very high resistance to moisture penetration. When applied over rusted areas, it maintains a plastic, flexible, and bonded coating on the metal that cannot crack and admit moisture. In addition, NO-OX-ID contains chemical inhibitors that check all under-film corrosion.

WRITE FOR DATA BOOK—Tells how to use NO-OX-ID on bridges, expansion bearings, turn-tables, track scales, underground pipe lines, etc.

DEARBORN CHEMICAL COMPANY
Dept. U, 310 S. Michigan Ave., Chicago, Ill.
New York • Los Angeles • Toronto

NO-OX-ID
IRON-OX-RUST
TRADE MARK
The Original Rust Preventive

Now 48
RAILROADS
Use BARCO
UNIT TYTAMPERS

Backed by 4 Years' Satisfactory Record

In out of face or gang tamping, they will give you better results at *LOWER COST*

BARCO MFG. COMPANY
1805 W. Winnemac Ave. Chicago, Ill.
IN CANADA
The HOLDEN CO., LTD. Montreal-Moncton-Toronto-Winnipeg-Vancouver

SPACE 75
ROADMASTER'S
SEPTEMBER
CONVENTION

It Cost the Company $3,000 to Put Off Re-Roofing

WHEN THE ROOF began to look a little doubtful, someone suggested that it should be re-roofed before winter, but someone else said: "Oh, let's take a chance. It's bonded for 20 years and it's only nine years old. If anything goes wrong, the bond will take care of us."

THE WINTER was pretty hard on the roof, and when spring came, there wasn't any question that the building would have to be re-roofed. So the bond was hauled out and the roofer was called in.

SURE ENOUGH, the bond was good, even if the roof wasn't, and the company was assured of a new roof without a cent of cost. But . . . when the old roof was taken off, it was found that serious damage had been done to the roof deck by the leaks.

A NEW ROOF DECK had to be built, at a cost of $3,000. The bond didn't cover that, and so it cost the company $3,000 after all. A bond is a good thing, but it's better to buy a good roof than a good bond.

THE MORAL of this true story is this: Bond or no bond, make sure your roofs are in good condition for the winter. Re-roof with a roof that you can forget about during the probable remaining life of the building—a Koppers Coal Tar Roof.

OTHER KOPPERS PRODUCTS

Koppers Waterproofing . . . Dampproofing . . . Bituminous-base Paints . . . Tarmac Road Tars for paving drives, parking areas, walks, etc. . . . Pressure-treated piling and other timber products.

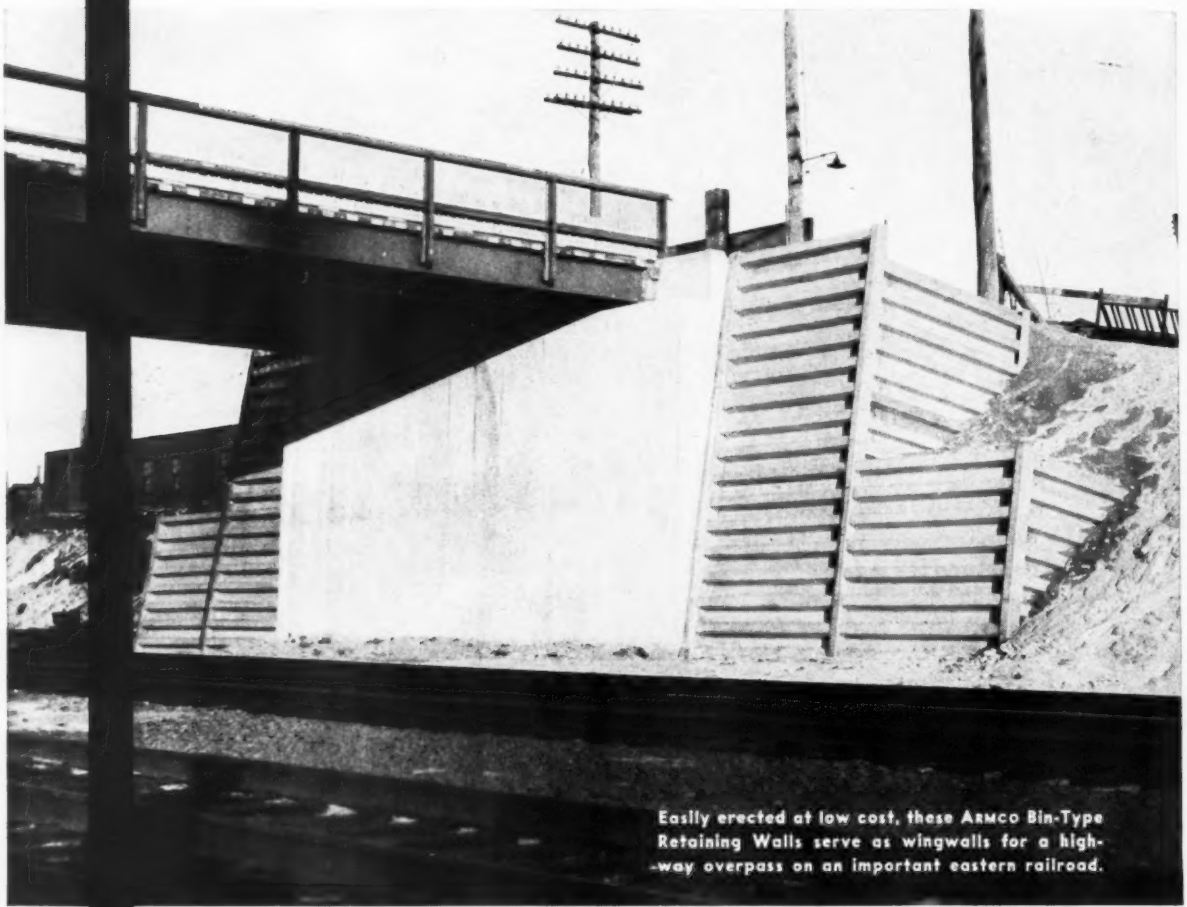
KOPPERS *Coal Tar* **ROOFS**

BONDED IF YOU LIKE . . . BUT BETTER THAN ANY BOND

KOPPERS COMPANY · PITTSBURGH

a KOPPERS product

HOW TO BUILD RETAINING WALLS



Easily erected at low cost, these ARMCO Bin-Type Retaining Walls serve as wingwalls for a high-way overpass on an important eastern railroad.

FASTER AND AT LOWER COST

This year when you dig into those problems of repairing embankment slips, preventing washouts, or settling right-of-way disputes, you will save in many ways by specifying ARMCO Bin-Type Retaining Walls.

Here is an improved cellular wall of galvanized iron that can be erected quickly in any season by your own maintenance crews. Hand wrenches and shovels are the only tools needed, since the heaviest unit weighs only 140 pounds. Very little excavation is the rule—and as soon as a site is opened up and assembly started, the iron bins can immediately be filled with earth. This reduces the hazards of retaining wall construction along streams, and in unstable spots where sliding embankments might possibly undermine the roadbed.

Best of all, in an ARMCO Bin-Type Wall *lasting* stability is assured by sound engineering design. Individual units are supplied in a range of gages to meet varying earth pressures against the wall. There's no danger of cracking or bulging, because the finished structure has sufficient strength and flexibility to overcome unequal settlement. Since the units are fabricated from galvanized ARMCO Ingot Iron (proved by a third of a century of dependable service) Bin-Type walls will serve for years. Write for the new 16-page catalog describing their practical advantages and uses. No obligation. Armco Railroad Sales Co., Middletown, Ohio. District Offices in the following cities: Berkeley, California • Chicago, Ill. Cleveland, Ohio • Denver, Colo. Houston, Tex. • Minneapolis, Minn. New York, N. Y. • Philadelphia, Pa. Richmond, Va. • St. Louis, Mo.

ARMCO ARMCO **BIN-TYPE RETAINING WALLS**

Where a Metal Culvert would have *Helped* . . .

HERE'S A WASH-OUT that could have been prevented at low cost by the proper use of U·S·S Copper Steel Culverts. A metal culvert, strategically placed, keeps water under control —where it will do no damage.

CURING A SLIDE BY DRAINAGE is the job that was given to this steel culvert. And here it has performed excellently—putting an end to the damage caused by a sinking roadbed. Corrugated Culverts of U·S·S Copper Steel are strong enough to be used with absolute safety under high fills as well as in shallower applications.

AN unexpected storm washes out a stretch of track. A wet spot or a water pocket causes track to sink. Schedules, men and equipment are tied up until the damage caused by inadequate drainage is repaired. Costly? You bet it's costly. And it's a maintenance expense that has to be paid over and over again unless the problem is solved . . . permanently.

The proper use of good culverts can do much toward making your roads safer and less expensive to maintain. Culverts of U·S·S Copper Steel are easy to handle, and inexpensive to install. They're strong and flexible, too —able to withstand the tremendous impact of constant, pounding traffic. And the addition of copper to the molten steel makes them much more resistant to the attacks of many forms of corrosion—gives them greater protection against rust.

Analyze your roadbed problems. Perhaps the use of more culverts can help solve them. You can quickly obtain culverts made of U·S·S Copper Steel from a culvert manufacturer near you. Or write to one of the companies below for any information you may need about their cost or application.

USS

Look for this symbol on steel products. It represents the highest quality, the finest metallurgical service.

COPPER STEEL CULVERT SHEETS

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*

Scully Steel Products Company, Chicago, *Warehouse Distributors* • United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

No. 129 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Our Editorials

September 1, 1939

Dear Reader:

Noting that a junior supervisory officer in the mechanical department of a western railway has been subscribing to Railway Engineering and Maintenance for some years, although this publication contains no information dealing with the work of his department, we made inquiry during the last month to ascertain why he did this. His reply interested us and I believe that it will interest you—and perhaps suggest to you a way in which you may secure an added return from your investment in our magazine.

To quote him, "I subscribe for Railway Engineering and Maintenance to secure its lead editorials," he said. In my opinion," he continued, "those editorials are the most thought-provoking I have access to. I use the information presented there in staff meeting discussions and in meetings with our foremen to get before these men basic facts regarding our industry."

We are, of course, greatly pleased with this report, for it confirms our belief that, if given the facts regarding the achievements of the railways, their contribution to public welfare and the unfair handicaps to which they are subjected, alert and loyal railway employees will disseminate this information widely, and that this dissemination will contribute to an informed public that will in time act to correct the injustices under which the railways are laboring today in their competition with other agencies of transportation.

This comment coincides with others that have come to our attention from time to time and that show us that many railway officers are making similar use of the information presented in these editorials. We wish that the practice might become universal among our readers and that through this means we might contribute to a more widespread understanding of the broad problems of the railways among the public at large in the same degree that we endeavor, through our feature articles, to contribute to greater efficiency in the conduct of the more specialized and technical problems of maintenance of way.

We are glad to receive this direct evidence of the use made of the material that we bring to you from month to month. We would like to hear from others.

Yours sincerely,

Elmer T. Howson

ETH:EW

Editor

MEMBERS: AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS, INC.

Take on These *Profitable* Partners

The International T-20 TracTracTor on a typical "off-track" job. There are five other crawler-type models in the International line, for gasoline, Diesel, and distillate operation. Five wheel-type industrial tractors are also available.

PROFITABLE PARTNERS, and how! Put International TracTracTors on your "off-track" work and the cost records will soon show you new lows in operating costs and new highs in work accomplished.

It's this unequaled *performance-per-dollar* that is turning the tide to TracTracTors.

When you go over TracTracTor design and construction, you'll see feature after feature . . . all engineered into these units to keep a higher percentage of the maximum drawbar horsepower continuously applied to get the most work done per day at the lowest possible cost.

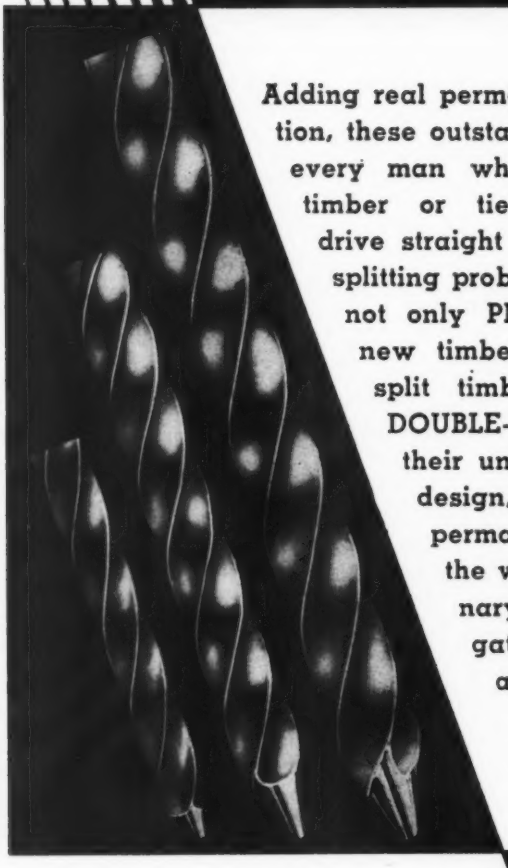
Get the benefits of International Harvester's experience as the world's leading maker of tractors. Put your power problems up to the nearby International industrial power dealer or Company-owned branch. And be sure to see the new 70 h.p. (drawbar) TD-18 Diesel TracTracTor—it's way out ahead in the big heavy-duty field.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
180 North Michigan Avenue **Chicago, Illinois**

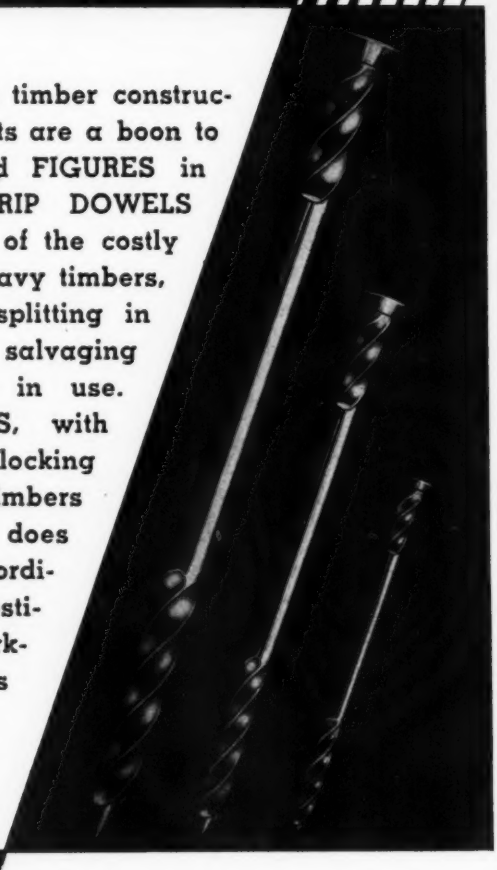
INTERNATIONAL Industrial Power

2 proved-in-service PRODUCTS

THEY ALWAYS STAY PUT AND INSURE LONGER LIFE ON HEAVY TIMBER CONSTRUCTION



Adding real permanence to all timber construction, these outstanding products are a boon to every man who works and FIGURES in timber or ties. GIANT-GRIP DOWELS drive straight to the heart of the costly splitting problem in all heavy timbers, not only PREVENTING splitting in new timbers but also salvaging split timbers already in use. DOUBLE-GRIP SPIKES, with their unique double locking design, join wood timbers permanently. One does the work of three ordinary spikes. Investigate these remarkable advances —send for samples.



Giant-Grip
REINFORCING
DRIVE DOWELS

Double-Grip Spikes

PITTSBURGH
SCREW AND BOLT CORPORATION
PITTSBURGH, PA.

GARY
SCREW AND BOLT COMPANY
GARY, IND.—CHICAGO, ILL.

American Equipment Corp. . . . . Norristown, Pa.

DISTRICT OFFICES: International Building, New York, N. Y. — General Motors Building, Detroit, Michigan — N. B. C. Building, Cleveland, Ohio — Post Office Box 222, Savannah, Georgia — Republic Bank Building, Dallas, Texas

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

SEPTEMBER, 1939

Editorials - - - - - - - - - - - - - - - - - - 515
Taxes—Rail Creepage—The Conventions

Rail Creepage—It Can Be Controlled - - - - - - - - 518
A discussion of the problem of rail creepage, the factors which affect it and what is considered good practice in overcoming it

Stops Slides with Drainage and Cinders - - - - - - - - 522
Describes the effective methods used by the Erie to overcome troublesome sliding and erosion of one slope of a deep cut

Renews Five Miles of Rail Cushion Timbers - - - - - - - 526
How the bridge and building forces of the C. & N. W. are renewing the rail cushion timbers in the Chicago passenger terminal of this road

Special Materials Prove Popular for Forms - - - - - - - 529
An abstract of a report presented before the A.R.E.A. discussing the effective use being made of plywood and pressedwood for forms

Track Buckles Under Freight Train - - - - - - - - - - 531
An I.C.C. report on an accident in which track being worked by an extra gang in renewing and spacing ties, buckled under a freight train

Supervisory Officers Must Sell Safety - - - - - - - - 532
A discussion of fundamental considerations in the promotion of safety by G. M. O'Rourke, district engineer, Illinois Central, Chicago

What's the Answer? - - - - - - - - - - - - - - 533

New and Improved Products - - - - - - - - - - - 540

News of the Month - - - - - - - - - - - - - - 541

ELMER T. HOWSON
Editor

NEAL D. HOWARD
Managing Editor

MERWIN H. DICK
Eastern Editor

GEORGE E. BOYD
Associate Editor

JOHN S. VREELAND
Associate Editor

F. C. KOCH
Business Manager

Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D. C.
1081 National Press Bldg.

SEATTLE
1038 Henry Bldg.

SAN FRANCISCO
485 California Street

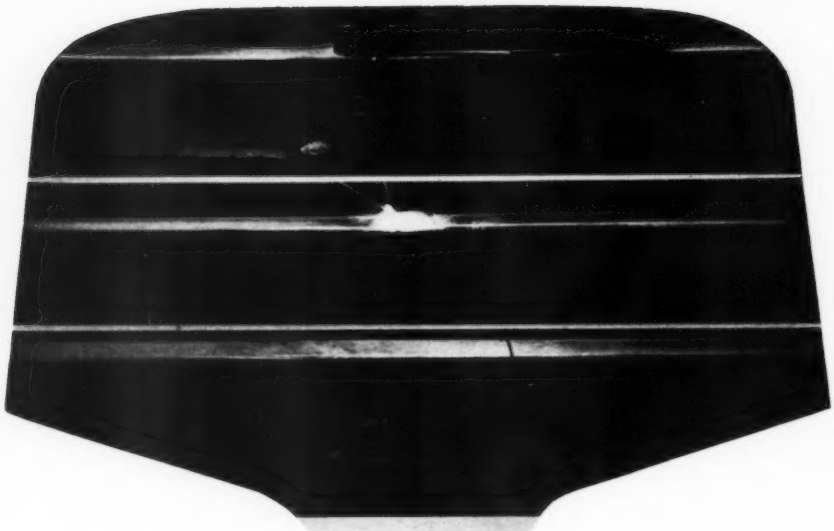
LOS ANGELES
Union Bank Bldg.

Samuel O. Dunn, *Chairman of the Board;* Henry Lee, *President;* Lucius B. Sherman, *Vice-President;* Roy V. Wright, *Vice-President* and *Secretary;* Frederick H. Thompson, *Vice-President;* Elmer T. Howson, *Vice-President;* F. C. Koch, *Vice-President;* H. A. Morrison, *Vice-President;* Robert E. Thayer, *Vice-President;* John T. DeMott, *Treasurer.*

Subscription price in the United States and Possessions, and Canada, 1 year $2, 2 years $3; foreign countries, 1 year $3, 2 years $5. Single copies, 35 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.)

PRINTED IN U.S.A.



AIRCOWELDING

RAIL ENDS

Aircowelding offers one of the most economical methods of building up worn and battered rail ends. It provides a proven oxyacetylene technique that cuts welding time in half, reduces gas and rod consumption and assures smooth riding track.

The savings made possible by Aircowelding are important. Airco customers have reduced their maintenance costs to a minimum through the combination of the Airco RR Rod, 99.5% Pure Oxygen, Acetylene, Apparatus and practical Engineering Assistance.

AIR REDUCTION

SALES COMPANY

General Offices: **60 EAST 42nd ST., NEW YORK, N. Y., DISTRICT OFFICES IN PRINCIPAL CITIES**

AIRCO SERVING RAILROADS FROM COAST TO COAST

Railway Engineering and Maintenance

Taxes

Railway and Truck Payments Compared

THERE are many evidences that the public and public authorities are awakening rapidly to the necessity for the elimination of the subsidization of highway transportation, not only because of its destructive influence on the solvency of the railways, but also because of the equally destructive results of this form of transportation on the physical structure of the highways themselves. One of these evidences is the increased activity of the highway transport industry in misrepresenting and befogging the issues in an attempt to confuse the public and delay the day of reckoning which the more astute among their number realize is at hand.

Indicative of the measures that this group is now resorting to is an advertisement that a builder of highway transport equipment is now distributing, showing that "in 1937 the tax rate on motor trucks was 47.6 per cent of their total valuation, while that paid by the railways was 1.43 per cent." This is an interesting comparison, if true. Its purpose is to show that "highway haulers pay their share of taxes." As such, it warrants analysis.

What Is a Tax?

This statement raises at once the question, What is a tax? In simple terms, it may be defined as "a charge or burden laid upon persons or property for the support of government." In this sense, the railroads paid taxes to the amount of $325,665,165 in 1937, and this sum went for the support of the public schools, for police and fire protection, for all the varied expenses of our city, state and federal governments—and even for the construction of the highways over which the trucks operate to take traffic away from the railways.

As for the trucks, the sums which their operators designate as taxes include registration fees, charges for dealers' licenses and plates, operators' and chauffeurs' permits, certificates of title, transfers and registrations, gasoline "taxes", and even fines and penalties imposed for breaches of the law. It is obvious that these are in no way taxes of the kind that a home owner or the railroads pay. On the contrary, these payments are in reality nothing more or less than rental charges for the privilege of using the public highways and streets as a place of business, with little or nothing going for the support of government. It is obvious that if the funds paid by other "tax payers" were to be spent for facilities for their special use, there would be no funds available for the support of the public schools, for fire and police protection, for the administration of justice; in brief, there would be no government, for there would be no one to support it.

Trucks or Highway Haulers?

Let us look at this statement from another angle. It is based on the premise that motor trucks paid total "taxes" of $417,510,000 in 1937 and from this concludes that "highway haulers" pay their way. But does this necessarily follow? What are these trucks? If we break down the units contributing to this tax total, we find included a million trucks operating solely in local delivery services within cities and towns, we find more than 900,000 farmers' trucks, we find also more than 926,000 farm tractors, and we find about 600,000 motor trucks, or only about 14 percent of the total number of motor trucks, engaged in hauling freight for hire and only one-third of these, or about 200,000, are engaged in inter-city transportation of the type that comes in competition with the railways. It is pertinent in this connection also to note that 89 per cent of the trucks sold in 1938 were of less than two tons' capacity. Furthermore, 80 per cent of all truck trips made last year were less than 20 miles in length.

The inclusion of all these vehicles in any discussion of the adequacy of road haul or highway hauler trucks can serve only one purpose—that of attempting to cover up the deficiencies in payments of these highway haulers. Confirming this conclusion, a study made by the United States Bureau of Public Roads in 1934 showed that trucks with capacities of 3 tons or more paid only 20 per cent of all "truck fees and taxes."

Is Valuation a Basis?

The motive prompting this comparison is shown nowhere more prominently than in the basis selected for the comparison—namely, the valuation of the trucks and the railways. Let us look at this basis. The railroad investment includes not only the cars and locomotives which transport the traffic but also the much larger investment in roadbed and tracks, in bridges, in buildings and all the many facilities required for the handling, care and transportation of the nation's traffic. To provide an accurate comparison, one should add to the investment in trucks a fair share of the $30,000,000,000 spent for the

construction of the streets and highways over which the trucks operate and by reason of which their operation is possible.

A much more fair basis of comparison is that afforded by a study of the proportion of the dollar each takes in that goes for the upkeep of their roadways, for interest on the investment in these roadways and for taxes. For these purposes, the railways spend 32½ cents of every dollar they earn—while the highways pay 7½ cents. Placed in this light, the boasts of the truckers and their associates are shown in their real light.

The Adequacy of the "Taxes"

Since the advertisement under consideration emphasizes the "taxes" paid by the motor industry, it is pertinent also to consider their adequacy, as rentals paid for the use of public property. Fortunately, a number of studies of this phase of the subject have already been made and their conclusions are available.

Interstate Commerce Commissioner Splawn has recently said, "The state and local governments * * * * are not getting in taxes from the vehicles operating on them anything like enough to keep up the roads and retire the bonds issued in building the highways." The judge of the federal district court for southern Illinois has recently ruled, "The motor vehicle fees and taxes collected from motor vehicle owners are insufficient to compensate the state and its subdivisions for that portion of the cost of providing highway facilities which is properly chargeable to motor vehicles."

The Highway Department of Missouri, after thorough investigation, found that the annual subsidy to common carrier motor trucks ranged as high as $409 for a five-ton truck and $680 for a nine-ton truck. In Illinois the State Highway Department found that the subsidy ranged up to $996 per year per truck. A study of highway costs in New York, made by a prominent consulting highway engineer, revealed a subsidy to highway users of more than $750,000,000 in the 10 years ending with 1934.

Professor W. D. Ennis of Stevens Institute of Technology reports in a recent study that New Jersey figures show a subsidy of $24,000,000 a year to highway users —most of this sum being accounted for by the heavier commercial trucks. Illinois reports that all the revenues received in 1936 from registration and other fees and motor fuel taxes amounted to less than one-half of that part of highway costs properly assignable to motor vehicles.

Three outstanding highway engineers—Clifford Older, formerly chief engineer of the Illinois Highway Department; Charles B. Breed, head of the Department of Civil and Sanitary Engineering, Massachusetts Institute of Technology; and W. S. Downs, professor of Railroad and Highway Engineering, University of West Virginia —recently completed a study of highway costs, concluding that the amount of subsidy granted to motor vehicles during the 12 years 1921 to 1932 was more than $9,750,000,000 and that these subsidies are continuing at a rate of more than $680,000,000 a year. In this study, the subsidy in the case of for-hire trucks was stated to be $108 in 1932 for trucks of 1½ tons and less capacity and ranged as high as $2,047.05 in that year for a combination of vehicles with capacity in excess of 5 tons. In the light of the foregoing facts compiled by these various authorities it does not seem that there is any question about the subsidization of the "highway haulers."

And This is Not All

There is one further point of interest in this regard, although it is not directly connected with the advertisement in question. Last year the American Association of State Highway Officials reported to a Congressional committee that to meet existing conditions the following improvements should be made "immediately" upon the "main or principal highways" alone:

57,755 miles should be rebuilt, at an estimated cost of $1,607,609,000; 21,424 miles should be widened, at an estimated cost of $683,447,000; 19,000 miles should be relocated, at an estimated cost of $978,812,000; 19,376 bridges should be widened or rebuilt, at an estimated cost of $394,428,000.

In other words, this program contemplates the improvement of 98,179 miles of highway and 19,376 bridges, at a further total cost of $3,664,296,000. The report did not indicate the proportion of this expenditure necessitated by the operation over our public roads of the large and heavy trucks of the "highway haulers." But one thing is certain. No portion of this expenditure was necessitated by the movement of freight in trains operated upon the tracks of the railways.

A Job for Employees

This, in brief, is the story which railway employees can disseminate among their neighbors in refutation of the smoke screen that is being thrown out so energetically today and that, if not cleared away, will bring disaster to the public as great as to the railways.

Rail Creepage—

Its Prevention Deserves More Attention

OF THE many problems that confront track maintenance men, one of the most common, and yet one of the most varied in character and extent—and on many roads still unsolved—is that of rail creepage. This problem is almost as old as railroading itself, and the fact that it has not been solved more successfully and universally does not reflect to the credit of maintenance of way officers who have made so many other outstanding improvements in the track structure.

Every maintenance man, from track foreman up, realizes the disadvantage of rail creeping. He knows that these disadvantages range all the way from poor alinement in open track and through turnouts and crossings, with the added work of correction which this involves, to actually dangerous conditions where creepage is excessive and uncontrolled. He knows that among these disadvantages are gage troubles, rail-end batter and chipping, high stresses in the rail and rail joint fastenings with the danger of breakage, and, on top of all this, poor riding track.

It is true that rail creeping is caused or influenced by a wide range of factors and that its extent varies widely with differing conditions of traffic, operation, climate,

alinement, grade and other factors. But, in spite of all these complications, it is significant that the problem still exists or is only partially solved on so many roads. It is significant, too, that, in view of its many disadvantages, more concerted study and investigation has not been given to the subject of rail creepage and means of overcoming it, for it would appear that the solution of this problem, already found by a number of roads through the application and proper maintenance of a sufficient number of modern rail anti-creeping devices to hold the rail in a fixed position, offers one of the most fruitful sources for further economies in track maintenance, while at the same time promoting a smoother riding and safer track structure.

In spite of all that is known about rail creepage, there is still much to be learned and appreciated about it by many maintenance of way men, and until this greater knowledge and appreciation are more universal, many maintenance officers will continue to be plagued with unnecessary track problems and unnecessarily high track maintenance costs. As a contribution to this subject, an article is presented in this issue which reviews the causes and results of rail creepage, and cites what is considered good practice in overcoming it.

The Conventions—

Plan Now to Attend

THE high points of interest in the near future for supervisory officers in both the track and the bridge and building departments are the annual conventions of the Roadmasters and Maintenance of Way Association in Chicago on September 19 to 21, and of the American Railway Bridge and Building Association in the same city on October 17 to 19. Many of these officers are already making definite plans to attend these meetings, but, large as this group may be, there are many more men who, with the encouragement of their superior officers, can so plan their work that they can attend the conventions.

These two organizations, which delve minutely into the everyday practical problems of the field, have records of achievement which have long commended them to railway managements. Year after year, they have tackled the intricate problems of track and bridge and building maintenance, whether they concern methods, organization, equipment or materials; year after year they have formed a melting pot and refinery for the best ideas and experiences of practical track and bridge and building men; and year after year they have proved invaluable in broadening the experience and in increasing the value of those men charged with the responsibility of maintaining the tracks and structures of the railways.

Much as these associations have contributed in the past, they possess opportunity to render still greater service to maintenance of way and structures men and their respective roads in the future, if these men, with the support and encouragement of their superior officers and railway managements, will enlarge their interest in the work which they are undertaking. And, in view of the past achievements of these associations, it is inconceivable that those supervisory officers who show enough interest in their own welfare and that of their roads to seek the benefits of these associations through membership and attendance at their conventions, will not have the support and encouragement of their immediate superiors, as well as the managements of their respective roads.

The program of the Roadmasters convention this year will give consideration to the relative advantages and disadvantages of specialized gangs as compared with section gangs; the maintenance of curves; the causes, control and maintenance of heaving track; the anchoring of track to meet present-day conditions; the qualifications and duties of roadmasters; and the utilization of roadway machines. The Bridge and Building Association, with an equally constructive program, will give consideration to the maintenance of shop and enginehouse roofs; the causes, detection and methods of repairing deteriorated concrete; present-day methods of safeguarding bridge structures; bridge painting problems resulting from deferred maintenance; pumping equipment to meet today's requirements; preframing treated timber for replacement purposes; glazing maintenance in shops and enginehouses; and the revision of bridge maintenance methods to eliminate slow orders.

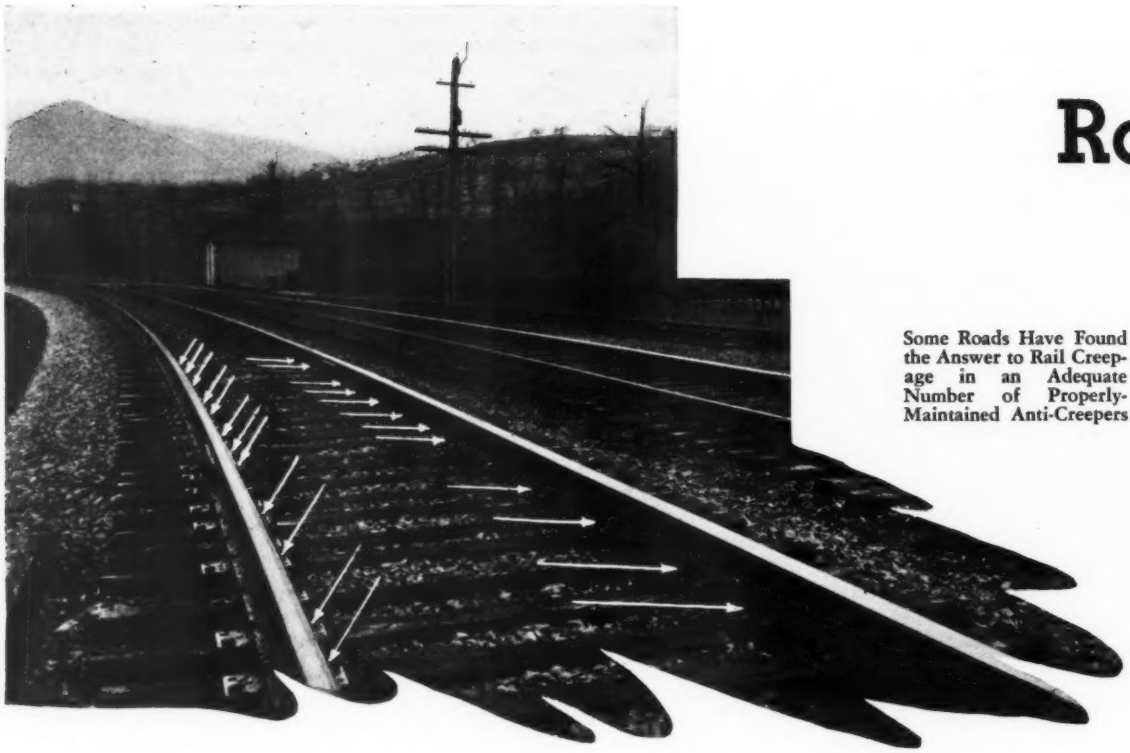
To get the most from the deliberation on these subjects, it is necessary that one attend and be active in the sessions at which they are presented and discussed. In no other way can the maximum benefit be derived. Furthermore, without an active, sizeable attendance, these associations cannot maintain the virility which has characterized them in the past and which has made possible the outstanding contributions which they have made to improvements and economies in track and bridge and building work.

With the increased responsibilities that are being placed upon supervisory officers in these days of economic stress, combined with the greater demands that are being made on the roadbed and structures, many of these officers will find it difficult to get away from their territories to attend the coming conventions unless definite plans are made in advance. But more than ever, because of these increased responsibilities that must be met by supervisory officers and the increasing problems with which they are being confronted, they should attend and get the most from the coming conventions.

The day has passed when any maintenance officer can afford to forego opportunities to exchange views and experiences with other men of similar responsibilities, for he never knows when, in these days of kaleidoscopic changes, he may suddenly be confronted with new conditions that require different methods than he has heretofore been accustomed to. It is then that the man of broad contacts demonstrates his superiority and paves the way for recognition and promotion. Nowhere can one secure a broader viewpoint on practical problems than by listening to and participating in the discussion of these problems on the convention floor.

These conventions constitute an educational opportunity of high order. It is not too early to begin planning now definitely to attend one or both of these conventions.

Rail



Some Roads Have Found the Answer to Rail Creepage in an Adequate Number of Properly-Maintained Anti-Creepers

NO experienced maintenance of way man, from section foreman up, questions the importance of preventing rail from creeping, and yet, longitudinal rail movement, under varying conditions, is common to every railroad, in every section of the country, and, to a varying extent, is a problem confronting every section gang. Much is known about rail creepage, the damage and increased work resulting, and of methods of preventing it, but there is much that is still to be learned or appreciated by many maintenance men in each of these respects, and until it is, rail creepage will continue to plague them, with resulting faulty track and unnecessarily high track maintenance costs.

Rail creepage is the problem that it is not alone because of the unfavorable conditions which result, but because of its variability under the same or widely differing conditions. It is influenced by so many conditions that, except in a most general way, it is not subject to accurate calculations, either as to the extent or the intensity of the forces resulting.

Causes of Creepage

The primary causes of rail creepage are known to be the undulating or wave motion of the rail under moving traffic; the braking action of trains, wherein the kinetic energy of the moving mass of the cars and locomotives is transferred to and overcome by the track structure; and the forces of expansion and contraction with temperature changes. But there is nothing constant from day to day about any of these, or about the results which they produce. In other words, the influence of traffic is dependent not alone upon the number of wheels passing over the track, but also upon the weight of the individual wheel loads, the spacing of the wheels, several characteristics of the motive power employed, including the counterweighting, and the speed at which trains are operated.

The influence of braking, at the same time, depends to a considerable extent upon the speed of trains, their tonnage and the rate of braking, and the effects of expansion and contraction are influenced not alone by the variations in temperature involved, but also by the rate of temperature change and its uniformity or lack of uniformity over a given distance, as may be influenced by partial snow and ice conditions, or even varying degrees of shade and sunshine produced by tunnels, cuts, hills, etc.

At the same time, it is known that in addition to the direct influence of train operation, braking and temperature, rail creepage is affected by many other factors, including the alinement and grade of the track, the character of the track structure, and the standard to which the track is maintained. Ordinarily, creepage is greater in a downhill direction, and is resisted to a greater extent by straight track than by curved track. Likewise, the tendency to creep is a function of the stiffness of the track structure. Thus, practically every phase of the track has a bearing on creepage, including the weight and section of the rails, the size and condition of the ties, and the depth of the ballast. In addition, even the type of ballast has a bearing, angular crushed stone ballast offering considerably greater resistance to movement of the ties and rail than some of the granulated or gravel ballasts, especially washed gravel. Obviously also, the extent of the spiking, whether single or double, and the character of the tie plates used, whether single-shoulder or double-shoulder, have a bearing on the frictional resistance tending to retard creepage.

In the matter of resilience of the track, the character and condition of the subgrade have important bearing, soft track increasing the undulating or wave motion in the rail under traffic, with corresponding increase in the tendency of the rails to creep. Likewise, the standard of general maintenance of the track has an important bearing on creepage. Thus, loose or frozen joints and irregular line and surface all beget increased rail creepage, with its resulting ac-

Creepage—

It Can Be Controlled

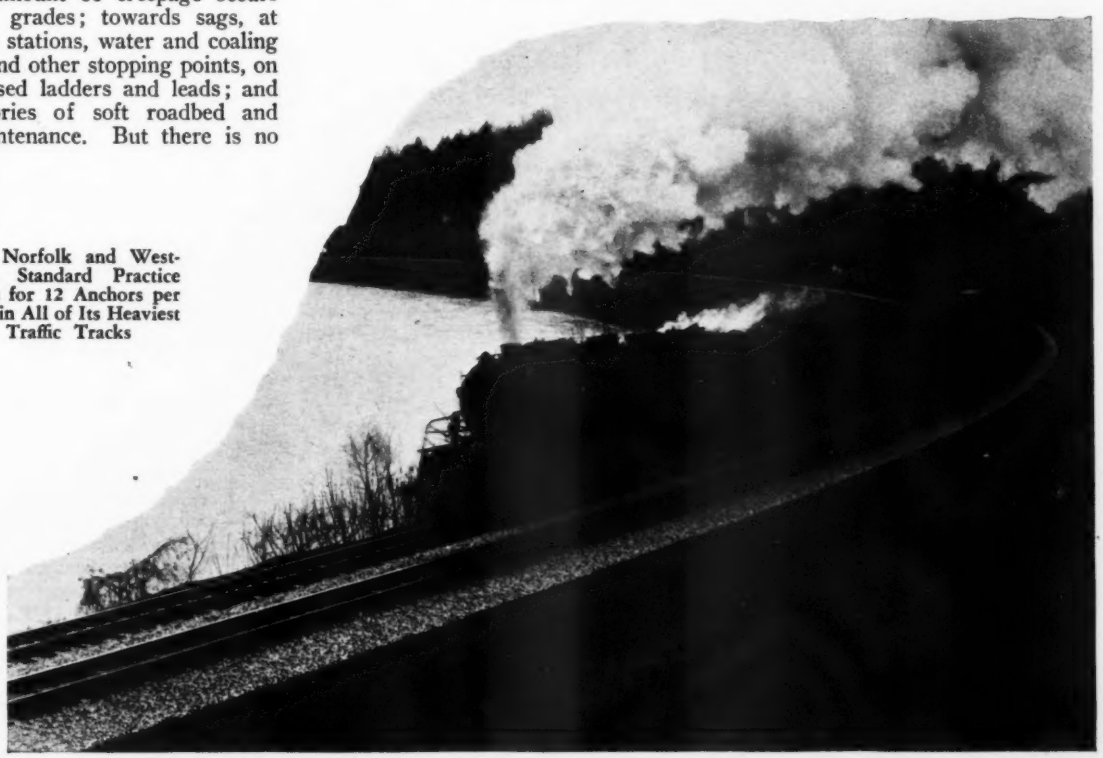
Rail creepage, with its many disadvantages, producing faulty track and unnecessarily high track maintenance costs, presents a problem to every track man, and will continue to plague them until they recognize the many factors involved and give them appropriate consideration. This article presents a review of the many causes and results of rail creepage and cites good practice employed in overcoming it

tion, which, in turn, has an adverse affect on those factors which help cause it. On the other hand, a well-drained and well-maintained roadbed is one of the most effective measures that can be adopted in minimizing the normal tendency of rails to creep.

Creepage Variable

Other things being equal, the greatest amount of creepage occurs on down grades; towards sags, at passenger stations, water and coaling stations and other stopping points, on heavily used ladders and leads; and in territories of soft roadbed and poor maintenance. But there is no definite rule as regards either the character or extent of the creepage. Frequently, both rails creep equally in the same direction, as might be expected, but not infrequently, one rail creeps more than the opposite rail. In other instances, rail has been observed to creep first in one direction and then in the other under traffic in opposite directions, and still other cases are on record of one rail creeping in one direction while the other rail creeps in the opposite direction. Where this latter condition has prevailed, it has been attributed generally to special characteristics of the motive power used. Some maintenance men have been troubled with increased creepage of the outside rail in double-track territory, a situation which has been attributed in certain instances to the less stable condition of the roadbed on the ditch side of the track, especially where drainage conditions are not the best, combined with the more frequent picking up of joints and other low points on that side, with the consequent disturbance of the track, which in itself is known to be conducive to rail creepage.

In addition to these variations and inequalities in creepage, a case has been observed of single-track rail creeping uphill in the early morning under a train moving uphill, and moving downhill late in the day un-



The Norfolk and Western's Standard Practice Calls for 12 Anchors per Rail in All of Its Heaviest Traffic Tracks

der an exactly similar train movement with respect to direction, wheel loads and speed. As a matter of fact, severe rail creepage has been observed in a section of abandoned track subject to no traffic whatever, and unequal creepage has been seen in closely paralleling tracks under identical conditions as to rail, ties, ballast, sub-soil and traffic.

In yards as on main running tracks, and through yard leads and departure tracks, the prevailing tendency of rail to creep is in the direction of the preponderance of traffic, but here also variations from the rule have been observed. In one large hump yard, for example, the problem encountered is not so much creepage down the hump and through the leads, affecting the track group turnouts in the direction of traffic, but rather the movement of the long body tracks against these turnouts in the opposite direction, largely due to expansion.

From the foregoing it is evident that in spite of any general trends of rails to creep in a certain manner, creepage follows no one known rule and, influenced by so many and variable factors, is not subject to ready, definite calculation. It is these facts, combined with the damage and additional track maintenance work resulting from uncontrolled creepage, that have made rail creepage one of the most aggravating problems confronting those track men who have not determined to control or prevent it by applying sufficient rail anchoring devices to hold the rail in place.

Disadvantages

The disadvantages of rail creepage are many and varied and, depending upon its extent, range all the way from poor alinement in open track and through turnouts and crossings, with the additional work of correction which this involves, to actually dangerous conditions where excessive and uncontrolled. In fact, rail creepage is known to be the genesis of, or an important contributing factor to many track maintenance problems. No track subject to rail creepage will long stay in good alinement, and with poor alinement come gage troubles, disturbance of the roadbed generally and poor riding conditions. In fact, excessive creepage presents the danger of buckling track, especially when combined with the forces of expansion in warm weather. It destroys the uniformity of joint gap openings, causing excessive rail end batter at the more open joints and rail chipping at intermittent open and tight joints. It causes high stresses in the rail, rail joint bars and joint bolts, with constant danger of breakage, and in some cases it brings about actual destruction of the ties, especially at joints, as the result of the movement of the joint bars over the ties and the necessity for frequent respiking.

Through turnouts, rail creepage is a constant source of maintenance work and expense, and if unchecked, will quickly distort an entire turnout assembly, throwing it out of line and gage, particularly at the frog and switch points. As a matter of fact, if the rail is not secured against longitudinal movement ahead of and through the turnout and for a reasonable distance back of the frog, it is impossible to hold the frog in good line and gage. At the same time, uncontrolled creepage can cause dangerous conditions at switch points, and, through binding of the switch rods against the head blocks or adjacent ties, can make throwing difficult and proper adjustment impossible.

The Proper Application of Anti-Creepers Is Essential to their Greatest Efficiency

Other places where proper rail anchorage is essential are at turntables and drawbridges of various types. Obviously, if the gaps at these locations are too large, rail batter and actual damage to the table or bridge structures can result, and, on the other hand, creepage toward the table or bridge opening, if not controlled, can actually prevent operation of such structures, with all of the serious consequences which might result.

Theory of Anchorage

Early practice in overcoming rail creepage was to anchor the rail by slot spiking at joints, throwing all of the force of the rail against the joint ties. As the result, the joint ties were slewed out of square, off their tamped bases, producing not only an unsightly condition, but, combined with the uneven support for the rail, many of the elements conducive to low joints and rough riding track.

With the advent of rail anti-creepers, a new and effective means was afforded for anchoring the rail, the theory of which was to distribute the forces in the rail to the ties and ballast adequately and uniformly so as not to disturb either. It was soon found that too few anti-creepers result in their slipping on the rail, or the movement of the ties laterally in the ballast, both defeating the purpose for which the expenditure was made, and the latter, in addition, actually adding damage to the track structure similar to that caused by slot spiking at joints in otherwise inadequately anchored track. In other words, it was soon learned that the holding power of anti-creepers on the rail was not the sole consideration. If this had been the problem it could have been solved readily. In fact, an early type of anti-creeping device had a bolted connection to the web of the rail and was spiked to the ties, but was unsatisfactory not alone because it pierced the rail to gain its fixity, but because it destroyed the ties through spiking, and carried them forward through imposing on them a force in excess of the resistance of the ballast in the cribs.

Number of Anti-Creepers

In present-day anti-creepers, all of which are designed to have a spring pressure or wedge grip on the rail base, recognition is given to the fact that there is no advantage in rail grip resistance greatly exceeding the resistance of the tie to lateral movement in the ballast. If, because of inadequate anchorage, it is a question of the ties moving laterally off their solid beds, with the slewing and misspacing which inevitably result, or the rail slipping through the anti-creepers, it is better that the latter prevail as the least damaging, because in either case the rail moves ahead.

The solution obviously is to apply a sufficient number of anti-creepers to the rail to distribute the forces in the rail, in its tendency to creep, against a sufficient number of ties to absorb these forces without the ties being dislodged on their beds. Thus, assuming the holding power of the anti-creepers on the rail to be equal to the resistance of the ties to movement in the ballast, the number of anti-creepers required depends upon the magnitude of the forces in the

rail and the resistance of the ties to movement.

With these fundamentals of rail anchorage becoming more generally known, and with greater appreciation of the disadvantages of rail creepage, many roads have effected much more satisfactory rail anchorage in recent years. With so many variables involved in both track construction and in traffic, however, the practices of no two roads are exactly the same throughout, and they likewise, vary from territory to territory and, in some cases, from point to point, as conditions require, on any individual road. Needless to say, if this adaptability to conditions were not followed, many sections of track would be inadequately anchored at the expense of other sections which would be over-anchored. The problem, therefore, is to adjust the number of anti-creepers to the needs of the particular territory or location, being just as cautious to avoid the unnecessary expense of over-anchorage as the increased maintenance costs resulting from insufficient anchorage.

Applying Anti-Creepers

In applying anti-creepers, the practice of the various roads is fairly uniform, and in accordance with the recommendations of manufacturers to place the smaller end of the anchor on the outside of the rail where it is least likely to be damaged by wheel flanges in case of derailments. Likewise, in the arrangement of the anti-creepers in each track panel, the general practice is to distribute them uniformly along opposite rail lengths, or as uniformly as possible, with bearing against both ends of the ties. However, while double bearing on the ties is followed almost universally, many variations are being experimented with in the distribution of the anti-creepers along the rail. In certain cases, the practice is to divide the number of anti-creepers and apply an equal number near each end. In another case, all of the anchors are bunched near the center of the rail, with the thought that, with the ties, they will act more as a unit, and that expansion and contraction will be equal and uniform both ways from the center of the rail towards the joint openings. In still another instance, a road is experimenting with an arrangement wherein all of the anti-creepers are bunched togther near one end of the rail, leaving the remainder of the rail free to expand and contract in one direction, toward the unanchored end.

Most anti-creepers are applied in connection with rail renewal work, and where such is the case, the consensus of good practice is that they should be applied immediately after the rail has been gaged, lined and spiked into final position, and before the expansion shims have been removed or the track is opened to traffic. This requires that the anti-creeper installation be kept close behind the gaging and spiking work, for only in this way can the uniform expansion gap openings at the joints, so

Many Points Require Exceptionally Heavy Anchorage to Insure Against Rail Movement

carefully provided for in the laying of the rail, be maintained.

Where anti-creepers are removed and re-applied in connection with joint gap adjustment work, made necessary by rail creepage or by expansion or contraction, they should be re-applied simultaneously with this work, with sufficient additional anti-creepers to prevent the repetition of the rail movement. Whether applied new or re-applied, the anti-creepers should be set on the rail as snug as possible against their bearing ties in the initial operation. But even at the expense of driving up the anti-creepers, they should be given an initial snug fit against the ties.

Whenever anti-creepers are removed and replaced, they should be replaced against the same tie as formerly to preserve the same arrangement of spacing, unless this is revised in connection with the application of additional units. However, when anti-creepers are re-applied in connection with tie renewals, the question of whether they should be re-applied against the new ties or against adjacent ties that have not been disturbed, becomes a matter of judgment, giving consideration to the kind of wood in the ties, the condition of the adjacent ties, whether the track has been raised or the ties dug in, and the kind and condition of ballast.

If the track is to be raised as much as an inch and resurfaced in connection with the tie renewals, which is not uncommon practice, it would appear desirable to replace the anti-creepers in their same relative position, against the new ties, because, in all probability, these ties will offer as much resistance to movement as any of the older ties, will be less subject to cutting by the anti-creepers than the older adjacent ties, and the established symmetry of arrangement, will not be disturbed.

Experience of N. & W.

A road that has given more than ordinary attention to the prevention of rail creeping is the Norfolk & Western. This road handles heavy tonnage coal trains from the coal fields of West Virginia both eastward to Norfolk, Va., and westward to Columbus, and Cincinnati, Ohio, these trains including up to one hundred sixty 70-ton loaded cars westward from Williamson to Portsmouth and Columbus, Ohio, a total distance of 210 miles, and up to 120 loads eastward from the coal fields to Tidewater, a distance of 350 miles or more. In hauling these trains it employs largely Mallet type locomotives with a total weight of engine and tender of 952,900 lb., and a maximum load on the drivers of 66,000 lb., although on the electrified portion of its Pocohontas division, it employs electric locomotives with a total weight of 832,000 lb., and maximum driver load of 75,000 lb.

With such trains and power, and a normal annual traffic density which exceeds 40,000,000 tons westbound from Williamson and 20,000,000 tons eastbound to Norfolk, this road was early confronted with a most serious problem of rail creepage. Year after year it continued to build up its track and roadbed, and to increase its means of anchoring the rail, until at the present time its main lines throughout are laid with 130- and 131-lb. rail, its present standard being 131-lb. R.E. rail, with 36-in. 6-hole joint bars and 8-in. by 13½-in. double-shoulder tie plates, canted 1 in 20.

In common with many other roads, the N. & W. first employed slot-spiking as the means of anchoring its rail, first alone and then in combination with anti-creepers, but, encountering the disadvantage of slot spiking, it abandoned this practice in 1927 and increased the number of anchors per 39-ft. rail length in main tracks to 10 wherever this proved necessary. Shortly thereafter the number of anchors per panel was again increased

(Continued on page 530)

The North Slope of "Four-Story" Cut, Shown in This View, Which Is Also to Be Stabilized in Substantially the Same Manner as the South Slope

Stops Slides

With Drainage and Cinders

TO bring about the stabilization of a highly troublesome slope in a cut where both slopes had been a source of difficulty for many years, the Erie recently applied a combination of corrective measures which are of interest because of their scope and character and their manner of installation. The location of this project is a cut on the Erie's low grade freight line, known as the Graham line, between Otisville, N. Y., and Harriman, on the New York-Chicago main line. The cut has a maximum depth of about 100 ft. and is about 800 ft. long. It was excavated through glacial drift embodying a mixture of clay, stones and boulders of varying sizes and, except at one location which will be mentioned later, no stratification of the material was evident.

The difficulties experienced at this location have been attributed to a combination of water seepage, frost action and surface erosion on slopes that were inherently unstable because of the character of the material of which they are composed. To effect a permanent cure of the slope that was giving the most trouble at the time, corrective measures were applied, which included the installation of a sub-surface drainage system for disposing of the seepage water, and the application of a covering of locomotive cinders over the face of the slope as a means of combatting the effects of frost action and preventing surface erosion.

Since the completion of these measures during the latter part of 1937, no further difficulty has been experienced with the slope, notwithstanding the fact that the rainfall during the spring and summer of 1938 was unusually heavy. In fact, practically no change can be detected in the appearance of the slope since the corrective measures were applied.

Nature of Trouble

Difficulties at this cut have been manifested in several ways. To a considerable extent the trouble was attributable to seepage from hidden springs which caused pockets in the side slopes to become saturated, thereby paving the way for the establishment of cleavage planes and the occurrence of slides. As a result of this condition, and also because of frost action on the slopes during the spring, slides occurred at relatively frequent intervals, occasionally being of such magnitude as to interfere with traffic. Because of the prevalence of these slides, it was necessary to maintain side ditches of greater than standard width and also to incur considerable expense in cleaning them following slides. Slow orders also had been required since the line was built about 30 years ago. Incidentally, because the cut was originally excavated in four successive steps, it is known as "Four-story" cut.

Because of their height and the character of the material of which they are composed, erosion of the side slopes during rain storms comprised another troublesome factor. Eroded material was not only being washed down into the side ditches but was also carried into the ballast, thereby increasing ballast-cleaning and track maintenance costs in general. Moreover, erosion of the slopes had the further effect of exposing boulders, many quite large in size, which occasionally were dislodged

Left—The Slip Scrapers, Operated in Tandem, Were Loaded With Cinders at the Toe of the Slope—Below—General View of the Cinder-Spreading Operations—Note Men on the Slope and the Hoist on Top

The slopes of "Four-story" cut on the Erie had long given trouble because of surface erosion and slides. To stabilize the south slope, which recently had been the worst offender, the railroad, as described in this article, reduced the angle of the slope, installed a sub-surface drainage system to tap hidden springs, and applied a covering of cinders

and rolled down the slope, thereby presenting a hazard to traffic. Removal of these boulders and the necessity for maintaining watchman service in the cut during the spring season and at other times during heavy rainstorms comprised further substantial items of expense.

Both slopes of the cut have given trouble from time to time. Originally, the north slope seemed to be the worst offender but in recent years that on the south side has caused the most difficulty. Trouble with the latter slope was largely attributable to the presence of three groups of springs, the most easterly of which appeared to be the largest and was the most troublesome. In 1934, a large slide occurred at this location and, as a temporary expedient, part of the slide material was restored to its original position and the remainder was disposed of by depositing it on the top of the slope, a dragline operating from the top of the slope being used for both operations. In 1936, another large slide took place at the same location and again a dragline was used to dispose of the displaced material.

Plan for Stabilization

Following the latter occurrence, the railroad determined to undertake the necessary steps to stabilize the south slope. Because of the more or less unrelated character of the several sources of trouble, it was evident that a combination of corrective measures would have to be applied. In coping with the seepage problem, it was decided to locate the source of water at each group of springs by excavation and to install pipe drains in trenches backfilled with rock for the purpose of carrying the seepage water down the slope to the side ditch. For solving the erosion problem and also to counteract frost action, the covering of cinders was chosen, this covering to be 2 ft. thick at the base of the slope and 1 ft. thick at the top. Moreover, as a means of adding further to the stability of the slope, it was decided to reduce it from 1½:1 to 1¾:1.

In locating the different sources

The Loaded Scrapers Were Dragged Up the Slope to the Proper Place and Then Dumped by Two Men

of water, an excavation of the necessary depth was made at each soft spot by means of a dragline operating from the top of the slope. When the springs at each soft spot (there were usually several) had been disclosed in this manner, branch drains were placed as required by conditions, the drains at each soft spot being so arranged that they converged into a single out-fall drain extending down the slope to the side ditch. All the drains installed in this project, including both branches and out-fall drains, consisted of 6-in. Armco coated, perforated corrugated pipe.

At two of the soft spots the location and tapping of the source of water proved to be a relatively simple task, but at the third—the soft area farthest to the east—a number of difficulties were encountered. In the first place this area was exceedingly soft and it was necessary to excavate to a depth of about 22 ft. before the several sources of water were located. In fact, when the excavation at this location had been completed in preparation for installing the drains, it was about 55 ft. wide (parallel with the track) and approximately 80 ft. long.

Three Gravel Strata

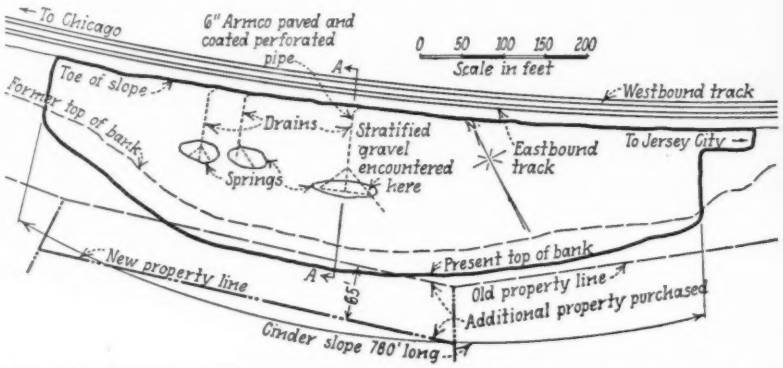
Secondly, the excavation at this soft spot revealed that the water was coming largely from three localized strata of gravel, and special provision had to be made for intercepting and collecting the flow of water along these strata. The latter were each about 3 in. in thickness and were separated by about 3 ft. of earth. To intercept the flow of water along the gravel strata, a line of the drain pipe about 50 ft. long was laid in the bottom of the excavation in a direction at right angles to the flow. At both ends and at its center this intercepting pipe discharges into other pipes of the same type and size, which converge into the out-fall drain a short distance down the slope. To tap a spring on the west side of this soft area still another drain was installed, which discharges into the converging drain that connects with the west end of the intercepting pipe.

At the other two unstable locations, it was not necessary to go quite so deep as in the foregoing instance in searching for the source of water and no stratified material was encountered at these locations. At the center soft spot two branch drains were installed, while at the most westerly location three such drains were placed.

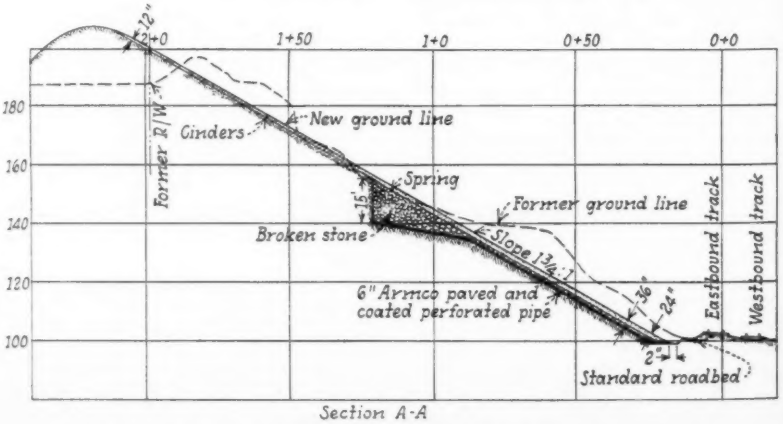
These branch drains were laid on a slight grade descending to a connection with the upper end of the out-fall drain. They were laid on a bed of broken stone and were covered with the same material to varying depths, depending on conditions. At the location where the intercepting drain was installed, the covering of stone placed over this drain was made sufficiently deep to cover also the face of the gravel strata to facilitate the percolation of water from the strata into the drain. When the branch drains had been installed, the pit was back-filled with cinders.

Placing the Mains

The drains that were installed for carrying the water down the slope were placed in trenches 2 ft. 6 in. wide and 4 ft. deep. In constructing these drains, they were first lined with broken bricks or old Belgian paving blocks. This material was arranged loosely along the bottom and sides of the trench, care being taken to obtain a uniform section of



Plan of the Situation at "Four-Story" Cut, Showing the Arrangement of the Drains and the Extent of the Cinder Covering on the Slope



A Cross Section of the Slope Through One of the Drains on Line A-A

such material, having large interstices. The bottom of the trench was then covered to a depth of about 8 in. with broken stone, after which the drain pipe was placed and the trench back-filled with the same material. At the lower end of each outfall drain a 7-ft. section of the pipe was attached by means of a 45-deg. angle joint and was turned so that the discharge is in the down-grade direction in the side ditch. Also, each 7-ft. section was so applied that it is on a one per cent grade, thereby further tending to reduce any disturbance that might be caused by the discharge of water from the drain into the ditch.

The flattening of the cut slope was accomplished partly by means of a dragline operating from the top of the slope and partly by a ditcher operated in a work train between 30-yd. air-dump cars, which removed material from the lower part of the slope and also loaded boulders that were too large to be handled by the dragline. A total of approximately 31,500 cu. yd. of material was removed in reducing the slope and in excavating the drainage ditches. For wasting the material removed by the dragline, and also to provide for the greater width of the cut due to the cutting back of the slope, a strip of additional property along the south side of the right-of-way, 65 ft. wide and about 500 ft. in length, was purchased, this expedient being considered more economical than haulage of the material to waste banks.

One of the Double-Drum Gasoline-Operated Hoists Used for Elevating the Loaded Scrapers

Excess Material, Including Boulders, at the Toe of the Slope Was Removed by a Shovel

Spreading the Cinders

Distribution of the cinders over the face of the slope, from piles dumped from cars along the track, was accomplished with the help of an ingenious arrangement of slip scrapers operated by gasoline hoists placed at the top of the slope. In this work two double-drum gasoline engine powered hoists were used, each with its separate arrangement of cables and scrapers.

Each set of equipment for spreading the cinders included, in addition to the hoist, the cable and the scrapers, two sheaves attached to the nearest track rail, about 15 ft. apart, and a "dead man," also comprising two sheaves, which was placed at the top of the slope. In each set-up a continuous cable extended from one hoist drum through the dead man and down the slope to the track, where it passed through both sheaves and thence back up the slope and through the dead man to the other drum. To each leg of the hoist cable in each set-up were fastened two 7-cu. ft. slip scrapers, so placed that when one pair was at the bottom of the slope the other pair would be at the top. Thus as one pair of scrapers was loaded and dragged up the slope, the empty pair was being returned to the toe of the slope on the other leg of the cable.

By using the dead men, which were moved readily as the cinder-spreading work progressed, it was possible for each set of cinder-spreading equipment to be moved from position to position along the slope within certain limits simply by changing the location of the dead man and the sheaves at the rail and without moving the hoist. More specifically, this arrangement permitted an area of cinders about 80 ft. wide (measured parallel with the tracks) to be placed on the slope before it became necessary to move the hoist to the next position. As completed, the cinder covering has a total length of 780 ft.

Operation of each cable and scraper set-up required the services of five men, one for operating the hoist and four for manipulating the scrapers. Two of the latter were stationed at the cinder piles for loading the scrapers while the other two unloaded them on the slope. Generally speaking, the procedure in building up the covering of cinders at each position of the sheaves and dead man in each set-up was to begin at the bottom when starting a new strip and work the cinders upward toward the top of the slope.

7500 Cu. Yd. Cinders Used

Utilizing the equipment and methods described above, as many as four cars of cinders were placed on the slope in one day. Altogether approximately 7,500 cu. yd. of cinders were applied to the slope, at a cost of 55.36 cents per cu. yd., including the cost of unloading them along the track, elevating them on the slope and spreading them. Similarly, the cost of removing and handling the 31,500 cu. yd. of material from the face of the cut was 25.96 cents per cu. yd.

Another aspect of this project that is worthy of note is the fact that, to facilitate future work on the slope by a dragline or other equipment, if this should become necessary, a roadway 12 ft. wide was constructed along the top of the slope. Moreover, to reduce to a minimum the

(Continued on page 531)

Renews

A View Through a Section of the Train Shed Where 26,000 lin. ft. of Timber Rail Cushion Was Renewed

Left—Setting in Place One of the New Treated Rail Cushions. Below—Tightening Nuts on the Hook Bolts with an Air Wrench

AN unusual and unique maintenance project is being carried out at the terminal passenger station of the Chicago & North Western at Chicago. This consists of renewing the longitudinal cushion timbers which are interposed between the rails and the stringers that support the tracks in the train shed. Since there are 16 tracks in the train shed, having an aggregate length of 13,000 lin. ft., and with a stringer under each rail, a total of 26,000 lin. ft., or approximately five miles, of timber is being renewed, the work being done virtually under traffic.

When the North Western constructed its terminal passenger station in 1911, the tracks were brought into the train shed, which is of the Bush type, at an elevation for the purpose of eliminating a number of crossings with busy streets. This gave an opportunity to utilize the space below the track level to house a number of the facilities that are incidental but essential to the operation of a terminal passenger station, and thus release an equivalent area in the station proper for other uses.

Tracks on Steel Supports

To take advantage of the space thus made potentially available, the tracks, platforms and train-shed roof were carried on structural supports, giving a large and fairly unobstructed area for baggage, express, mail-handling and other facilities at street level. Since it was necessary to protect these facilities from the elements as well as from oil and water that might drip or be discharged from locomotives and cars, it became necessary to waterproof the entire deck of the track area.

Each rail of every track in the train shed is supported on a series of stringers, formed as built-up girders, and framed into cross beams at the supporting bents. All of the structural members in the deck were encased in concrete. Instead of supporting the rail directly on the steel stringers, a wood cushion consisting of 8-in. by 16-in. by 26-ft. timbers, sized on four sides to 7½ in. by 15½ in., and laid flat, was interposed between the rail and the stringers. These timbers were secured to the stringers by means of hook bolts which slip through slots in the concrete encasement and are thus prevented from turning. Enough of these bolts were installed to hold the timbers rigidly against lateral movement, and thus insure maintenance of gage. The rails rest on tie plates and are secured to the timbers by means of screw spikes.

Deck Is Waterproofed

The concrete encasement was carried up to about mid-height of the cushion timbers, but was sloped away from the rails to a series of floor drains located between the rails, between tracks and between tracks and the platforms. The concrete encasement was stopped short of the cushion timbers, however, to form

Five Miles of Rail Cushion Timbers

A project that illustrates the wide diversity of work that the maintenance forces of a railway are called upon to perform is being carried out by bridge and building forces of the Chicago and North Western, at its terminal passenger station at Chicago. This is the renewal of the cushion timbers upon which the track rails in the train shed rest. The magnitude of the job is indicated by the fact that five miles of timbers are involved. This article describes the methods that are being used and points out how the work has been facilitated by the use of power tools.

Pouring the Liquid Asphalt Waterproofing in the Spaces Along the Sides of a New Cushion Timber

Applying and Nailing the Asphalt-Saturated Cotton Fabric Flashing Along the Edges of the Cushion Timbers

Each Layer of the Flashing Was Mopped Separately with Hot Asphalt, and the Top Was Given a Heavy Coat

a channel, with sloping sides to facilitate the placing and removal of these timbers. The waterproofing was formed by mopping all exposed surfaces with an asphalt primer, upon which two plies of asphalt-saturated fabric were laid. They were protected by a layer of asphalt mastic, and the mastic was finished with two moppings of hot asphalt, dry cement being dusted over the second or final hot asphalt mopping while it was still plastic.

Treated Timber Used

In recognition of the importance of preventing water from entering around the edges of the waterproofing, special preeautions were taken in the design with this objective in view. In renewing the timbers it was necessary to destroy this flashing, the first operation in connection with this renewal being to cut out the asphalt surrounding the timber. The method of replacing the flashing will be described later.

When the passenger terminal was constructed in 1911, treated wood was installed beneath the rails. These timbers lasted until 1923 and 1925, during which period they were renewed with untreated wood. The present renewal is being made with

creosoted material, in the expectation that a longer life will be obtained. None of the timbers that have been removed have shown any indication of failure through crushing, although many of them have shown evidence of decay.

Short Interval for Work

This is a stub terminal in which trains enter and leave the train shed at the north end. Because of the close headway between incoming trains during the early hours of the morning, no work can be done on any of the tracks until the morning rush is over. Likewise arrivals and departures begin early in the afternoon, so that tracks are available to the maintenance forces for only a few hours during the day. To avoid the possibility of leakage into the facilities occupying the space beneath the tracks by reason of unexpected storms during the night, it has been necessary for the forces engaged in renewing the timbers to complete the work on all of the track that has been opened, including the restoration of the waterproofing, within the time the track can be assigned to them during the day, meaning virtually the intervals between trains. As a result of this limitation, a day's work ranges from 3 to 5 timbers or 84 to 130 ft.

The first operation is to cut out the asphalt mastic, using a concrete buster equipped with a special cutting tool. This is generally done during the day prior to the removal of the timber, temporary protection being installed to prevent leakage.

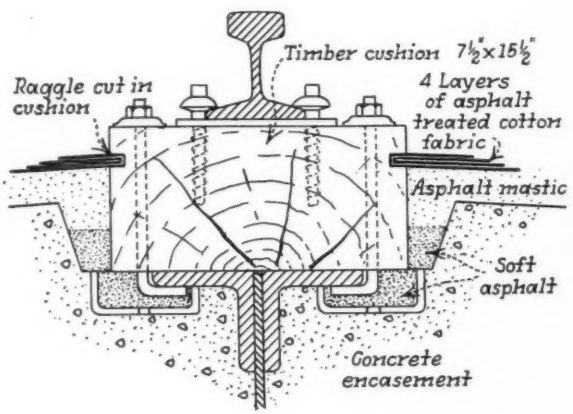
As soon as the track is released in the morning the screw spikes holding the rail are backed out of the old timber and the nuts are turned off of the hook bolts, this being done with a portable bolting machine operating on current from the lighting circuit in the train shed. The rail is shifted over without being uncoupled, enough spikes being removed at each end of the work to allow the rail to be lined into the clear.

Next the old timber is lifted out, the hook bolts are removed and the top surface of the stringer flange is cleaned, primed and mopped with hot asphalt. The hook bolts are then restored and the new timber set in, the timbers having been prebored for the hook bolts but not for the screw spikes. As soon as the timber has been placed, the nuts are tightened on the hook bolts, and the tie plates placed. The rail is then shifted back into position and tacked to gage. While the rail is thus held in position, the holes for the screw spikes are bored with an electrically-driven wood borer that takes its power from the lighting circuit, and the screw spikes are driven.

Applying Waterproofing

The timber is now ready for the waterproofing and flashing. In applying the waterproofing, approximately 2 in. of soft asphalt, heated to a liquid state, is deposited in the bottom of the channel space between the timber and the concrete encasement, and the remainder of this space is filled with asphalt mastic, which is troweled to conform to the sloping surface leading to the floor drains. For reasons that will be explained in the following paragraphs, the mastic is carried up along the vertical face of the timber to a point 1⅜ in. below the top surface.

Prior to treatment, grooves ⅜ in. wide and ¾ in. deep were cut into both vertical faces of the timbers 1 in. below the top, to provide anchorage for the flashing. After the mastic has been troweled to the desired surface and brought to the elevation of the lower edge of the groove, two thicknesses of asphalt-saturated cotton fabric are folded, forced into the groove and nailed in position at intervals of 12 in. Each layer of the fabric is then mopped separately in hot asphalt, and a heavy mopping is applied to seal the flashing anchorage.



Cross Section Through One of the Rail Cushions, Showing Details of the Fastenings and Waterproofing

Provision for Joints

Since the timbers are cut square and simply abut against each other, special provision for sealing the joints thus formed became necessary. Before the rail was applied, the top and side surfaces of the adjacent timbers were mopped with hot asphalt and two layers of the saturated fabric were embedded in the mopping and carried down the sides of the timber to an anchorage in the flashing groove. This completed the operation.

At the time the first renewal was made, the work was carried out over a period of three years. The present job was started late in 1936, a small amount of the timber being replaced that year. Further renewals were made as needed in 1937 and 1938, and at present two tracks remain to be cared for, with work on one of these being carried on currently. It is expected that renewals on both of these tracks will be completed within the next few weeks.

Power Tools Used

Mention has been made of the power tools employed on the job, and while they were few in number, consisting of a concrete buster, a portable power wrench and a wood borer, they greatly facilitated the work. If it had been necessary to perform by hand the various operations of cutting out the mastic, removing and tightening nuts, and boring for and setting the screw spikes, the time involved would have been so great that the amount of work that could be performed in the short intervals that the tracks are released would be reduced considerably. Increasing the force to compensate for hand work would be no gain, for while all of the men engaged in the work are needed, there is not room for additional men to work and most of them therefore would be idle a considerable portion of the time.

The work is being carried out by the division bridge and building forces under the direction of E. L. Mead, division engineer, and under the immediate supervision of Andrew Olson, supervisor of bridges and buildings on the C. & N. W.

The Use of Plywood and Pressedwood for Forms Has Become Increasingly Popular in Recent Years

Special Materials Prove Popular For Forms

In recognition of the increased application of plywood and pressedwood in the construction of concrete forms and form linings, a subcommittee of the Committee on Masonry of the American Railway Engineering Association, of which L. W. Walter, inspecting engineer, Erie, Jersey City, N. J., was chairman, presented a report on the subject at the convention of the A.R.E.A., which report is abstracted herewith

PRESSEDWOOD and plywood as materials for forms and form lining have become popular within the last seven or eight years. Not only has the facility with which forms may be constructed with these materials contributed toward their popularity, but under many circumstances their use also effects savings in cost.

Plywood

Plywood is ordinarily made from Douglas fir and may be had in standard thicknesses of three, five or seven plies. In the manufacture of this material selected logs in appropriate lengths are turned in a giant lathe which causes sheets to be peeled off in almost endless lengths. These sheets are assembled to form the plywood by gluing them together with water-resistant glue which sets under hydraulic pressure to form a bond of high shearing strength. Successive plies are placed at right angles to each other with respect to the direction of the grain, so that, in addition to a tendency to resist warping, the finished product has the benefit in both directions of the maximum strength of the wood fibers in both tension and shear.

Plywood may be had in thicknesses ranging by increments of 1/16 in. from 0.25 in. to 0.75 in. Various widths are carried in stock and widths up to a maximum of 48 in. can be obtained. Sheets 24 in. and under in width are given a base unit price, while the unit price of sheets in excess of 24 in. in width varies according to a sliding scale. The weight of three-ply plywood (3/8 in. thick) is about 25 lb. per cu. ft. This material is available throughout the country and can usually be obtained at local lumber yards in a number of sizes and thicknesses as desired.

Pressedwood

Pressedwood is manufactured by pressing shredded wood together under heavy pressure and at a high temperature in such a manner that the fibers are compressed into sheets of equal strength in all directions. To minimize the absorption of water, the surfaces of the material are "tempered" with hot oil. Pressedwood is manufactured in pieces 4 ft. by 12 ft. in size and in thicknesses ranging from 3/16 in. to 5/16. in. In manufacturing this product, the edges are finished with such a high degree of accuracy that, where full-size sheets are used, the joints do not require pointing or filling.

In the construction of forms there is no single application in which pressedwood and plywood are used to the exclusion of other materials. They are, however, recommended especially for use where the appearance of the concrete is of importance, for forming curved or warped surfaces, and to carry out ornamental and architectural details.

They may be used either as forms or as form lining. When used as forms they are simply attached to the studding and are not assisted by sheathing in resisting the pressure of the concrete. When the materials are used in this manner the thickness required will depend on the spacing of the studding, the consistency of the concrete, the rapidity with which it is placed and the method of placement. Ordinarily a five-ply plywood, or its equivalent in pressedwood, is used where no sheathing is employed. Where these materials are used simply as form liners, three-ply plywood, or an equivalent thickness of pressedwood, is ordinarily used.

Certain details connected with the

method of use of these materials have an influence on the extent to which they may be re-used and, consequently, upon economy. When not in use, the panels or sheets should be so stored or handled as not to cause warping or to produce excessive bending. Care should be exercised in the removal of nails or other fastenings and, where smooth, even surfaces are to be obtained with each re-use, the operations of erecting and dismantling must be done in such a manner as not to peel, scratch, mar or roughen the surfaces. The effect of any damage that may be done to the surfaces can frequently be minimized by reversing the sheets or by using those forms with marred surfaces in locations where the surface of the concrete will not be seen.

The maximum number of re-uses will be obtained when the forms are constructed in panels with supporting studding so that it is only necessary to connect or disconnect the studding in order to erect or dismantle the forms. When live steam is used under canvas for heat curing, plywood is frequently damaged sufficiently to reduce the number of repeat uses. Before it is used, plywood should be oiled to prevent the absorption of water, which will tend to raise the grain and separate the plies. Pressedwood, on the other hand, should be used in a slightly moist condition, this being best accomplished by wetting the sheets on the screen side about twelve hours before using.

When plywood is used for built-in-place forms it should be nailed at about four to six-inch intervals along all four edges and with one nail per square foot for the entire surface. Three-penny shingle nails or small box nails should be used. Smooth joints may be obtained by nailing the edges of the abutting sheets to the same back board. Plywood 9/16 in. or more in thickness may be used without backing, in which event the sheets are nailed directly to the studs.

Both plywood and pressedwood may be cut with a power or hand saw and dressed with a plane to make close-fitting joints. Joints that are open enough to permit the insertion of a knife blade should be closed by pointing them with patching plaster or with quick-hardening cements or compounds. When either pressedwood or plywood is used for lining forms, backing boards consisting of 1-in. by 4-in. dressed and matched lumber are recommended. These boards should not be more than six inches wide and should be firmly attached to the studding and placed in proper alinement to support the lining.

When plywood is used for lining large form panels for repeat usage, there may be some advantage in using a filler strip of lining between the ends of the lining on adjacent panels. Also, when it is necessary to saw off ragged edges of the lining at vertical joints, a filler strip can be inserted to fill the gap.

Where the choice of form materials lies between plywood or pressedwood on one hand and other materials on the other the decision will be governed by such economic conditions as the number of re-uses that can be expected, whether the structure will permit the use of plywood or pressedwood as forms without backing, whether the forms may be made up in panels for easy erection and removal, the surface finishing cost and the relative cost of these materials as compared with ordinary matched form lumber.

In addition to plywood and pressedwood, transite board, a composition of asbestos fiber and cement, has been used successfully as a material for concrete forms and also as a protective agency for concrete on bridges over railway tracks.

Rail Creepage—Can Be Controlled

(Continued from page 521)

until today its standard practice calls for 12 anchors per 39-ft. rail on all main line track in double-track territory with a traffic densisty of 20,000,000 tons or more. This includes the eastbound main track from Williamson to Norfolk, and the westbound main track from Williamson to Columbus, handling the heaviest loaded traffic. On the opposite tracks in these same territories, handling largely empty car movements back to the coal fields, 8 to 10 anti-creepers per rail length as a rule have been found sufficient to prevent creepage of the rail.

Adapted to Conditions

In solving the problem of rail anchorage this road does not follow any arbitrary standard blindly, but rather installs enough anti-creepers in each location or territory to eliminate rail creepage. Under its heaviest traffic, 12 anchors per rail length, in combination with its heavy track construction and stone ballast section, have been found adequate, as have 8 to 10 anti-creepers per rail length in its lighter tonnage main tracks, but regardless of this general rule, there is no hesitancy to apply additional anti-creepers per rail length in any location where needed to insure complete stability of the track. Thus, at many locations on the road, at important stations, at coaling and watering points, through interlockings and at certain types of road crossings, one will find in excess of the standard out on the line, as conditions may require to hold the rail against movement.

The same considerations which have led to positive anchorage of the main line rail have been carried over to all of the important branch lines of the road, especially in recent years as the weight of power has been increased on many of these lines and the need has become apparent for more secure anchorage. Most of these branch lines, now laid with 100-lb. to 130-lb. rail, have 8 to 10 anti-creepers per rail length against movement in the direction of loaded traffic. In most cases, the heavier anchorage was effected at the time these branches were relaid with heavier rail released from main line tracks, but in many branch territories, with the inauguration of heavier power in advance of the heavier relay rail, the original lighter rail was heavily anchored to offset the increased tendency to creep under the heavier power and increased train loads.

And so through its system, the Norfolk & Western has taken advantage of rail anti-creepers to offset the disadvantages of rail creepage. Its problems have been somewhat simplified by the fact that, owing to the preponderance of loaded movements in one direction over most of its lines, rail creepage has been largely in one direction and less variable than on many single-track lines with widely fluctuating traffic densities in both directions. Thus, most of the rail anchorage on the N. & W., is in one direction, with loaded traffic, and, normally, the number of anti-creepers applied are distributed uniformly throughout each rail length. However, each variable problem of creepage encountered is treated individually, and there is no hesitancy to increase or decrease anchorage as may be found necessary or in the interest of economy, or to anchor in both directions if condtions require.

As a result of this policy of positively anchoring its rail, the N. & W. has overcome the many disadvantages of rail creepage, with largely improved track conditions and sizable economies in almost every phase of track maintenance. In increased rail life alone, the added cost for sufficient anti-creepers has been more than justified, the road having witnessed a marked increase in the life of its rail, with minimum rail end batter and chipping, since the adoption of its policy of full anchoring.

Track Buckles Under Freight Train

TWO cars were derailed in a freight train and three employees were injured as a result of buckling track on the Missouri Pacific, near Sheppard, Ark., on June 2. In the report of this accident made by the Bureau of Safety of the Interstate Commerce Commission, from which this information is abstracted, it is stated that new 112-lb. rail had been laid during April, and that at the time of the accident an extra gang was engaged in renewing and spacing ties under the new rail. This gang was working on the section of track involved in the accident and had removed some of the track spikes preparatory to continued prosecution of this work.

The report also states that one of the rules of the maintenance of way department of this road stipulates that in pulling spikes ahead of a rail-laying operation it is ordinarily safe to pull spikes from two ties, leaving the spikes in the third tie, except on curves where spikes may be removed only from alternate ties, but that the condition of the ties must be taken into consideration and correct gage must be maintained. Other rules specify that roadmasters and supervisors must bring their foremen to realize that speed restrictions interfere with train movements and that slow orders must be placed only when required for safety; but that main tracks must never be obstructed without displaying stop signals in both directions, and that flagmen must be sent out whenever the track is unsafe for the passage of trains.

The train involved in the accident consisted of a locomotive with an auxiliary water car, 22 loaded and 50 empty freight cars and a caboose. The rear car and caboose were derailed at 2:05 p.m., the weather being clear and the temperature 86 deg.

The evidence adduced at the investigation indicated that the track had been kept filled with ballast, which was washed gravel, and that a track jack was being used to ease the rail off the ties that were being removed. Immediately prior to the accident the gang was working on a section of three rail lengths and, according to the testimony of the foreman, spikes had been pulled from alternate ties, except at one point where two adjacent new ties just installed had not yet been spiked.

The engineman stated that the track did not appear to be out of line and that it rode smoothly, and this was corroborated by the fireman and head brakeman. No speed restriction was in effect, and the train was traveling at a speed variously estimated to have been from 35 to 60 miles an hour. When the caboose reached the section of track upon which work was being done, it was derailed, later derailing the car immediately ahead.

Both rails were subsequently found to be out of line, first to the west, a distance of half gage, then to the east and back again to the west, each of these kinks being about 1½ rail lengths, or slightly less than 60 ft., and there were several shorter kinks where the caboose had evidently knocked the track out of line after it had been derailed. However, the rail was neither bent nor overturned and it was not necessary to replace any of it. Following the accident, a gradual curve was lined into the track to allow trains to pass and later in the day, when it was cooler the track was restored to its original alinement without either rail having been driven back.

The roadmaster testified that when he arrived on the ground about 45 minutes after the derailment he found the track in gage, but that the spikes had been pulled from both rails in two ties out of three and that at two points within three rail lengths there were three adjacent ties from which the spikes had been pulled. He stated that never before had he observed any gang working with as many unspiked ties as he found in this instance, and that he believed that the kinks occurred because too many spikes had been pulled. Both the roadmaster and the assistant roadmaster testified that they had given the foreman oral instructions to open no more than one rail length at a time, but this was disputed by the foreman who said that he had not received such instructions.

In its discussion of the evidence, the Bureau reported that the foreman said that he ordinarily opened only one rail length at a time, but that in this instance the ballast worked easily, with the result that the spacing unit got ahead of the spiking and that three rail lengths were open. The Bureau called attention to the fact that the rules do not specify a definite length of track that may be opened, and suggested that the conflict in testimony on this point could have been avoided if written instructions had been issued. There was also a definite dispute as to the number of spikes that had been pulled, and the Bureau suggested the possibility that some spikes may have been pulled through the disturbance of the track at the time of the derailment.

In concluding the discussion, the Bureau said that apparently the track was tight as the result of expansion resulting from moderately high temperature; that the washed gravel did not offer as much resistance to lateral movement as some other types of ballast; and that it had been loosened as a result of the work that was under way, thus further reducing its resistance. It also concluded that the unspiked ties would further lessen resistance, and that these conditions, combined with the movement of the train on a descending grade, caused the track to buckle.

Stops Slides

(Continued from page 525)

amount of water flowing onto the slope from above, a berm ditch, set back 3 ft. from the edge, is provided along the top of the slope.

As stated previously, the measures described above have entirely eliminated the trouble due to slides and erosion that formerly afflicted the south slope of "Four-story" cut, and because of them it is no longer necessary to maintain the side ditch to a greater width than standard. In fact, so well pleased is the railroad with the results obtained that plans are being made to apply similar measures to the north slope of the cut.

The work described above was carried out under the general direction of J. C. Patterson, chief engineer maintenance of way of the Erie, at Cleveland, Ohio, and I. H. Schram, engineer maintenance of way of the Eastern district, at Jersey City, N. J., and under the direct supervision of B. Blowers, division engineer of the New York division, also at Jersey City.

Supervisory Officers Must Sell Safety*

By G. M. O'Rourke

District Engineer, Northern Lines
Illinois Central System, Chicago

IN recent years much scientific planning has been done to find the best methods and means to be employed to reduce accidents. The developments that are taking place are not spectacular or widely publicized, but they are progressing day by day.

Safety, according to Funk & Wagnalls' dictionary, is "The state or condition of being safe; freedom from danger or risk; freedom from injury." To be free from injury, men must be taught to avoid danger and risk. When that is thoroughly learned they will be in "the state or condition of being safe."

Boss Must Set Example

To be successful, safety educational work must come down from the top. The great mass of men follow leaders. They may protest against the fact, but they do it just the same, for they cannot help it. When we pass judgment on an employee, we are obliged to inquire what kind of an example has been set for him by his supervisor. The elimination of careless practices demands a change of mental attitude on the part of every employee. An indication of this change must emanate from the "Big Boss."

The development of a proper safety attitude among subordinate officers constitutes the first and most important step in the educational work of any safety organization. Friendly competition is a stimulus for good safety records. Contests between divisions and departments have been found effective. The desire to excel, when encouraged by competition or recognition of merit, is a strong force for the prevention of accidents.

The monthly news letters on steam railroad safety, published by the Steam Railroad group of the National Safety Council, are an important contribution to safety promotion work and are used extensively at division safety meetings on the Illinois Central. The reading of these letters and other safety literature pertaining to railroad operation and to the specific types of work conducted by the maintenance of way and structures forces serves to keep the division engineers and supervisors informed regarding safety developments and to furnish them with helpful material for use at safety committee and staff meetings. Frequent safety letters to employees from the division superintendent will do much to convince employees of the importance of safety. Posters, homemade bulletins, cartoons, photographs and statistical material, placed on bulletin boards, are also helpful.

Safety Awards

Recognizing that educational activities among workmen are of primary importance, as the largest percentage of personal injuries results from unsafe practices rather than from unsafe conditions, the management of the Illinois Central, several years ago, began issuing safety merit cards to road supervisors, signal foremen, water service foremen, section foremen, bridge and building foremen and extra gang foremen. The plan provides for one, two, three, four- and five-year cards. Thereafter, veteran's safety cards are issued to those having a 100 per cent safety record for the men under them for periods of six or more years. When these records are broken as the result of an injury to an employee under the supervisory officer's supervision, or to the supervising officer himself while working in a supervisory capacity, he is compelled to start over and to work his way up the ladder again.

Another means of encouraging safety promotion work on the Illinois Central has been the introduction of an employees' suggestion system. This is operated as a regular company department through permanent committees, which meet once a week on each of the road's ten divisions, under the supervision of a general committee which meets in Chicago. Experience has convinced the management that practically every employee on the railroad is in a special position to see and to suggest economies and improvements in company work and in safety practices.

To obtain suggestions, the company offers liberal cash payments for employees' ideas found practical in application. The name of an employee making a suggestion is not revealed, even to the committee, until and unless the committee calls him into conference, or the suggestion has been accepted and payment is to be made.

Division safety meetings are indispensable if organized as an active means to spread safety to the working force. When held at regular intervals, these meetings afford excellent opportunity for division officers to keep in close touch with the accident situation and to emphasize repeatedly the safety policies of the company.

Every encouragement is given subordinate officers and employees to enter freely into the discussions at the safety committee meetings. The enthusiasm aroused in a meeting and the indication that the executives, supervisors and employees alike are interested in the movement, usually have a pronounced effect. Through example and precept the division engineer should awaken in his men a regard for the welfare of others, and cultivate a feeling of duty with respect to their conduct towards others.

The supervisors should, in turn, hold safety meetings of their foremen. Mechanics and laborers from nearby gangs should be invited. The most successful meetings are those conducted for the express purpose of placing responsibility upon individual employees for the elimination of unsafe practices. One of the truths which we specially need to grasp is that the average man in the ranks is not a peculiarly gifted man and that he must be trained to be safety-minded.

Foremen Have Responsibility

We deem it highly desirable on the Illinois Central for the foremen to conduct certain safety promotion activities among their men. Short, informal meetings provide an opportunity to discuss problems of safety intimately. Rule books are provided foremen in order that they may become thoroughly acquainted with railroad safety regulations, thereby encouraging more widespread observance of safe practices. Safety calendars are sent out the first of each month with the time rolls. A safety rule number is inserted under each date to indicate the rule to be read by the foreman and discussed with his men each working day.

The amount of sincere interest displayed by many gangs, when questioned in the field, reflects the foreman's attitude towards safety. When he makes every possible effort to encourage safe practices by precept and example, and displays an active safety leadership, his men will pay attention to safety. Foreman leadership in safety is essential and should be actively encouraged and insisted upon.

*Part of a paper presented before a regional safety meeting of the Safety Section of the Association of American Railroads held in conjunction with the Seventeenth annual Midwest Safety Conference at Chicago.

Causes of Dead Track

What causes track to ride "dead"? What effect does the speed or density of traffic have? What should be done to remedy the condition? Why?

Never Formulated

By H. R. Clarke
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Chicago

So far as I know, an authentic definition of "dead" track has never been formulated. This expression is one that is quite generally used by trackmen, however, and as used refers to track that has lost its spring or resiliency and therefore results in rough or choppy riding, which cannot be overcome or corrected by the usual picking up or smoothing of track. This condition develops when track is not surfaced with sufficient frequency. The time required for the condition to develop depends on several factors, including speed, density of traffic, character of the ballast, character of the subsoil, etc. To remedy the condition, the track should be given a light running surface, new ballast being added as may be necessary, and this will usually, if not always, overcome the condition described as dead.

Unyielding Ballast

By G. S. Crites
Division Engineer, Baltimore & Ohio, Punxsutawney, Pa.

"Dead" track is the result of compacted or unyielding ballast. This comes about by reason of the spaces between the ballast particles becoming filled with dirt that sifts in from the top; through ballast wear or disintegration; and as a result of mud squeezing up from the bottom. Both speed of trains and density of traffic have the same effect on ballast that a vibrator has on a batch of concrete; that is, they cause the particles to work closer together, but with the added factor that they abrade the ballast, wearing dust-like particles off the materials, thus providing a good filling, and sometimes a good cementing, material.

The quickest and most satisfactory way to put the breath of life into dead track is to give it a general raise. Where a general surfacing is out of the question, cleaning or renewing the ballast is the only remaining solution. Either will free the ballast immediately adjacent to the ties of the filling and compacting fine material, and give a certain amount of elasticity to the ballast and ties under load. If dead track is allowed to go without the proper attention it is likely to become center bound, a condition that should be corrected as soon as possible, for center bound track is very troublesome track.

All Elasticity Gone

By W. L. Roller
Division Engineer, Chesapeake & Ohio, Columbus, Ohio

In railway parlance, track becomes dead when it reaches that state in which all resilience or elasticity is gone, when the ties become so embedded in the ballast as to make the track structure inert or lifeless, transferring to the moving equipment every impact from the roadbed, instead of absorbing the shocks as is normally intended. The basic principle governing the construction and maintenance of what may be called the American type of railway track is that the ties shall have their bearings at the ends, or as nearly so as practicable, and that the centers of the

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in November

1. *When rails that have been reconditioned by welding are released, for what further service are they adapted? Do they require special treatment before or after they are relaid? Why?*
2. *What is the most practical finish for hardwood floors in railway offices? In stations? Why?*
3. *Should the supervisor examine the scrap originating on his district before it is loaded for shipment, to prevent the inclusion of usable material? Why?*
4. *What attention should be given to water barrels on bridges to insure that they are affording the desired protection at all times? What special precautions are necessary in cold weather?*
5. *What are the advantages and disadvantages of employing a tie inspector to determine tie renewals?*
6. *What precautions can be taken to prevent pipe lines from freezing during severe cold weather?*
7. *Is it advisable to use salt to prevent accumulations of ice around switches? Through interlocking plants? Why? What other means can be employed more advantageously?*
8. *Should sash in enginehouses and shops be painted in the fall or winter? If not, why? If so, what are the advantages?*

ties shall be unsupported. This principle of support allows a certain amount of resilience in the track structure, partly by reason of spring action in the crossties and partly by reason of similar action in the rails.

When the track loses this type of support, or settles into the ballast bed sufficiently to receive support throughout its entire length, thus losing this spring action, it may be termed "dead." This quality of inertness is not always easily discerned when riding over tracks, although it has certain definite characteristics, such as extreme solidity and immobility, giving forth dead sounds as equipment passes over it. The impact of the wheels at the joints is more like anvil blows because of the compactness and rigidity of the roadbed.

The process of becoming inert or dead is a gradual one and grows as the track proper becomes more and more imbedded in the surrounding ballast, thus shifting the support from the ends of the ties to their entire length. This kind of track is more apt to become center bound, and can often be detected by reason of that characteristic. As the support tends to extend more and more throughout the length of the tie, the process continues by the support falling away from the ends of the ties, finally leaving them supported only at the center, that is, riding on a ridge, as it were. At this state, the track has become center bound, this being the final stage of dead track.

Natural subsidence of the track into the ballast as a result of repeated traffic loads is the primary cause of dead track. If the track is not lifted and tamped, this subsidence continues until the tie rests on ballast throughout its length. This settlement of track is quite pronounced, particularly under heavy tonnage, being especially in evidence at highway crossings and station platforms. The only practicable means of overcoming the bad riding qualities of dead track is to surface it out of face, thus restoring the support to the ends of the ties, freeing the ties from the ballast inside of the rails and restoring the track to its former elevation before subsidence began.

This condition is caused by the passage of traffic loads over the track and progresses in almost direct ratio to the tonnage that the track carries. This is an item of vital importance in maintenance and should not be neglected. Surfacing to raise the track from its bed not only improves its riding qualities but restores the desired resiliency, arrests joint batter and reduces joint maintenance. Restoring resiliency promotes operation at speed with safety.

Insulating Existing Buildings

To what extent is it practicable to insulate existing buildings? When should this be done? How? What are the advantages?

Depends on Many Factors

By Frank R. Judd
Engineer of Bridges, Illinois Central, Chicago

The extent to which it is practicable to insulate existing buildings and the type of insulation to be used are often governed by the type of construction which the building represents. In buildings with masonry walls, the insulation is usually limited to the roof or the ceiling of the top floor, because these walls have a large heat-absorbing capacity, and furring provides an air space that retards heat flow. On the other hand, walls of frame buildings require insulation, and this can be applied readily to such buildings.

In general, the use of insulation is determined by the location, character of occupancy and type of construction. Without question it should be used in all buildings that are air conditioned, in buildings having flat roofs and low ceilings, in buildings used for cold storage, in buildings where uniform temperatures must be maintained and in metal buildings that are to be heated or used for shops or offices. Insulation should also be used in all buildings where condensation must be overcome or avoided.

The principal types of insulation are as follows:

1. The rigid type, made up of sheets of compressed granulated cork, shredded wood, cane or other fibres which can be handled easily. This type can be applied under the roofing, as a plaster base or as interior finish.

2. The flexible type, composed of felted fibres which are sometimes enclosed with fabrics to afford protection against infiltration. These materials are treated to provide resistance to moisture, fire and vermin. This type of insulation is usually applied in the spaces between framing members.

3. The fill type, consisting of shredded, granulated or powdered material, properly made from minerals. They are inorganic, incombustible and usually vermin and moisture proof. This type may be placed by hand or blown into the walls and other spaces by air.

4. The reflective type, consisting of thin highly polished sheets of metal which reflect radiated heat. It should be used only in conjunction with air spaces. This type of insulation is generally nailed between studs or rafters in such a way that there is an air space on each side.

The advantages of insulation are that it provides better working conditions for the occupants of the buildings to which it is applied; it prevents condensation; it permits a reduction in the size of the heating and air-conditioning plants; and it conserves fuel. A properly insulated building will require from 10 to 20 per cent less radiation and will reduce fuel consumption by 15 to 25 per cent, compared with the same building without insulation.

When Making Repairs

By General Inspector of Buildings

From the physical standpoint it is practicable to apply insulation to any building. The desirability of doing so, however, will depend on the use of the building, its physical condition and its probable future. Insulation is applied for three principal reasons —to improve the comfort of the occupants, to conserve fuel and to protect commodities. The latter purpose includes cold storage, ice storage and the protection of perishables against low temperatures, and can be ignored, because the application of insulation in this instance is made during the construction of the facility.

I am a firm believer in the desirability of insulation to conserve fuel and improve comfort. Many years of experience in the building field have convinced me that it is not only desirable but economical to insulate buildings that must be heated. This desirability is emphasized when it is realized that relatively few railway buildings, particularly those of frame construction, are fully weather tight and that a great many do not even approach weather tightness. Experience has shown that sufficient savings will result from the use of insulation, if it is applied during the construction of the building, to pay for its own cost and the cost of the heating plant within a short time, say 4 to 7 years.

Savings of equal magnitude are possible through the application of insulation to existing buildings, but since the cost of application may be higher in this case, it may take longer to offset it. Yet, I have known of cases where savings of as much as 50 to 75 per cent of the fuel costs were realized from the application of insulation to existing buildings.

In general, at present the greatest advantage can be realized by insulating the smaller and moderate sized station, office and similar buildings. These structures have been sadly neglected of late and many of them are badly in need of a general overhauling. The time to apply insulation is when work of this character is under way, for it can be done at a lower cost if done in connection with these repairs. Furthermore, besides getting a better job, the building itself will be in far better condition, which will add to the advantages of the insulation for many years.

Applying Joint Bars to Rail

What details should be given particular attention in the application of joint bars to new rail? Of new bars to old rail? Why?

Observe Same Care

By Thomas Walker
Roadmaster, Louisville & Nashville, Evansville, Ind.

I can see no particular difference between the application of joint bars to new rail and new bars to old rail, for I believe that, in general, the conditions are the same and the same care should be exercised in making the application. One of the first details to be given attention in applying joint bars to either new or old rail, is to see that the fishing surfaces are given a good coating of oil. This tends to minimize the freezing of the joints to the rail and, to a certain extent, allows for a freer movement of the rail in expansion and contraction. Obviously, this is not a complete cure for frozen joints, but it is of real help in preventing this undesirable condition.

Care should be observed to see that the bar makes a good fit with the rail. Usually it is necessary to drive the bar into place by striking the base of the splice with a spike maul before the bolts are tightened. Unless this is done, the bar may be cocked and will not make the proper contact with the fishing surface of the rail. Again, care should be taken to have the bars fit snugly in the longitudinal direction, for if this is not done, lips may be left on the rail. I think it is quite important to watch this point.

Finally, care should be given to drawing the bolts to insure that they are tightened uniformly, as this will help to keep the rails in alinement and thus avoid the lips that result when there is an offset between adjacent rails. As a general thing, it is better to tighten the middle bolts first and the end bolts last, although I doubt whether this is of great importance, and it is not desirable when power wrenches are being used, because it requires the shifting of the wrench from one side of the rail to the other. The main thing, so far as wrenching is concerned, is to have the nuts tightened uniformly to the proper tension.

No Difficult Problem

By E. L. Banion
Roadmaster, Atchison, Topeka & Santa Fe, Marceline, Mo.

While the correct application of joint bars to new rail does not present a difficult problem, there are certain fundamentals that must be followed when making the initial application if best results are to be obtained. The benefits from the greatest care that can be exercised will be lost, however, unless the joints are properly maintained thereafter. The most important feature of application is uniform bolt tension. Regardless of whether the bolts are tightened by power wrench or by hand, no bolt should be fully tightened before all of the others have been given some tension. In other words, this operation should be progressive until all bolts are to the same tension. Improper tightening of the bolts often leads to difficulties in joint maintenance.

Fishing surfaces and the area under the bar should receive a coating of heavy lubricant to insure the retention of this oil as long as possible. This will reduce corrosion, prevent frozen joints, minimize the bunching of expansion and retard wear on the fishing surfaces caused by movement in expansion and contraction. There would be an advantage in freezing joints to eliminate this without wear, but since this is not practicable with our present methods of anchorage, the alternative is to reduce wear and secure uniform movement in expansion and contraction.

Continued wear on the fishing surfaces will eventually result in the loss of enough metal to prevent proper head and base bearing. When this occurs subsequent tightening of the bolts merely draws the bars to a bearing on the fillet between the web and head of the rail or against the web, so that the base and head support are gone and the bar acts as a joint strap only. This results in dropped rail ends and low joints.

Going back to the application of the joint bars, to secure a uniform bolt tension, every bolt must be threaded accurately and each spring washer must have the same elasticity; otherwise the tension reading of the bolt will not indicate its actual tightness, but possibly the stress set up in getting the nut on a damaged bolt. New well-oiled bolts should always be used when applying joint bars, for only slightly corroded threads will often indicate the required tension when the bolt is not actually tight and the spring washer is not fully compressed. Improper lubrication or absence of lubrication occasionally results in stripping the threads.

The design of new bars for old rail will depend on the amount of wear on the finishing surfaces of the rail. Frequently, so much wear has occurred that bars of normal section will not suffice, in which case reformed or over-filled bars become necessary to compensate for this wear. This presents no special difficulty on track on which the traffic is about equal in both directions. Here a crowned bar with a uniform taper both ways from the center will provide satisfactory compensation. However, on multiple-track lines, the principal wear occurs on the receiving end of the rail under directional traffic, and requires that most of the metal for overfilling shall be placed on one end of the bar. Failure to devise some satisfactory system for rehabilitating worn rail ends is creating one of the pressing problems of maintenance. If this can be done, the life of the rail can be further extended and riding quality of the track improved.

Use Plenty of Oil

By J. E. Emond
Roadmaster, Atchison, Topeka & Santa Fe, Clovis, N. M.

Regardless of whether new bars are to be applied to new or old rail or whether the latter are reformed bars, the rail should be swabbed liberally

with oil, to prevent the freezing of the joints as a result of accumulations of rust and dirt. When bars are applied, care should be exercised to see that they are driven in from the bottom first, and that they are well tightened before the joints are spiked. If this is not done, when the bolts are retightened, or as the bars are seated, the joint will become loose in the spikes as a result of the bars being pulled in at the bottom. If the bars are driven in properly at the bottom when they are applied, the retightening will affect the fit at the top only, where most of the wear occurs.

Failures in Waterproofing

What are the causes of failure in waterproofing? What means can be employed to reduce such failures?

Two Types of Failure

By C. C. Westfall
Engineer of Bridges, Illinois Central, Chicago

Our experience with failures of waterproofing on bridge decks has been limited to mechanical failures, as contrasted with failures of the materials. These are of two types, one, in which the joint filler between slabs or between slabs and parapet walls has receded from the plane of the bridge deck, permitting the waterproofing to be punctured or broken by the ballast. This occurred in our earlier experience, but was readily overcome by using a metal plate over the open joint, rather than depending on the joint filler to support the load.

The second type of failure, which we have not as yet taken care of satisfactorily, is occasioned by the rupture of the waterproofing at the joints between the slabs, or at the joints between the slabs and the parapet walls, crosswise of the track. This can be traced to movement of the slabs either from contraction or as a result of the passage of trains. We have favored the practice of mopping the built-up waterproofing to the surface of the slabs, on the theory that if a leak occurs it will be confined to the point where the membrane becomes broken. This results, however, in the several layers of the waterproofing fabric acting as a unit with the slab, so that when any movement of the slab occurs, it must be taken up in the stretch of the waterproofing for such distance as it has been laid free from the slab at the joint.

Any scheme for providing excess length for the waterproofing at the joints does not seem to be practical and it is probable that the only way to overcome the trouble is to arrive at the proper length of the constituent fabric laid dry, that is, so that it will not adhere to the slab. It is now our practice to lay a strip of roofing paper across the joint, thus preventing a bond between the waterproofing and the concrete. Only experience will indicate the proper distance each side of the joint that should be treated in this way, but it seems probable that in most cases a total distance of 36 in. should be satisfactory.

Provide Anchorage

By George E. Robinson
Assistant Engineer, Cleveland, Cincinnati, Chicago & St. Louis, Cincinnati, Ohio

Good design, good material and good workmanship are popularly supposed to guarantee good results. Probably few who read this will admit that they have neglected any of these essentials; yet the record is replete with failures that have resulted from neglect of one or more of them. Waterproofing failures are generally caused by insufficient attention to details in both plan and execution. Under present-day specifications for material it is doubtful whether we can produce a failure in the body of the waterproofing, even if the workmanship were mediocre, except as a result of external damage.

A perfect waterproofing job demands the complete exclusion of water, not only over the main part of the surface but at every point around the perimeter. If one can keep the first trickle from getting under the edges, 90 per cent of the potential failures will never materialize. Flash and seal the edges and carry the waterproofing far enough below ground level so that capillary attraction cannot draw water to a vulnerable spot, and our chances are excellent to start with a perfect job.

We must also provide protection against penetration, abrasion and tearing. The secret here is not so much the type of protecting coat as it is the efficacy of the anchorage intended to hold the protective coat in position. We must eliminate all relative movement between the waterproofing and its protective coating and between the waterproofing and the surface upon which it is laid. In other words, we must solve the problem of insuring relative immobility between the waterproofing and the materials with which it is in contact; unless this is accomplished failure is certain.

Inspecting Water Columns

How frequently and by whom should water columns be inspected? What details should be given attention?

Once a Month

By J. P. Hanley
Water Service Inspector, Illinois Central, Chicago

Water columns are usually maintained and inspected by the water-service repairman assigned to the district upon which the water columns are located. He should inspect them, and make any needed repairs, at intervals sufficiently frequent to insure that they will be kept in good operating condition, in the same manner that he maintains the pumps, pipe lines and other water facilities on his district. In addition to this local inspection and maintenance by the repairman, the division water-service supervisor should make it a point to inspect the water columns once a month at the time that he makes the usual station-to-station inspection of the facilities.

It is good practice to give all water columns a general overhauling in the fall to insure that they will function properly during cold weather. At this time the drains should be cleaned, packing replaced, and valve seats and other worn parts repaired and cleaned, or replaced. In other words, the column should be put in such condition that repair work and the opening of the pits for long periods during freezing weather will be avoided as much as possible. A thorough overhauling is generally sufficient to allow the water column to function satisfactorily for a year with the minimum of attention, except for oiling, packing and routine adjustments, which should be done as required.

Details requiring special attention when the inspection is being made include drainage, the locking mechanism, packing, lubrication and adjustments to give capacity delivery with minimum water hammer. As the drainage is not visible without inspection, considerable water may be wasted unless this item is given special and prompt attention. The locking device, whether this consists of cams or manual locks, should be maintained in good condition to prevent high winds from turning the column from standard clearance. The large locomotive tenders that are now in common use require the capacity flow of water columns to prevent delays to trains, and adjustments to insure this flow should be maintained. This requirement calls, in turn, for careful adjustment of the pressure release valves to prevent water hammer with resultant damage to the water column and water mains.

Give Frequent Attention

By Engineer of Water Service

Locomotives are helpless and serious train delays occur when the water supply fails. Since the most common means for delivering water to locomotives is through water columns, it is obvious that the importance of maintaining water columns cannot be overemphasized. This device, like all others in railway service, is likely to develop defects at almost any time. It is only through regular inspection that some of these defects can be detected in time to prevent them from growing into failures.

Logically, the man to make the primary inspection is the district repairman, for not only is he responsible for the condition of the equipment, but his duties require him to be frequently at the points where the water columns are located. I believe in systematic inspection of all facilities, and that it is specially important that the inspection of water-service equipment be systematized to insure that it will function continuously, as well as to impress upon the repairman the importance of this phase of his work. For these reasons, the inspections should be scheduled, although obviously there will be times when emergency calls or other duties will prevent him from following the schedule exactly. This primary inspection should be supplemented by a monthly inspection by the water-service supervisor, while system water inspectors should make it a point to examine the water columns when they are at a water station.

A water column is a relatively simple mechanism, but all details are important. First of all, the inspector should assure himself that the drainage of the pit and of the column itself is in good shape, for poor drainage may result in other troubles. Next in importance is the locking mechanism. This device, whatever the design, must be in good working order to insure that it will function when the spout has been returned to idle position, and that the column will not rotate under the pressure of high winds. All packing should be examined to insure against leakage, and the lubrication should be noted to insure easy movement.

With the demand for faster delivery of water, created by shortened train schedules and the increased capacity of locomotive tanks, the inspector should satisfy himself that the column is adjusted to give the desired rate of flow. He should watch the action of the pressure release valves and know that they are adjusted to prevent water hammer when the column is being shut off.

Deferring Tie Renewals

To what extent is it practicable to defer the renewal of a certain proportion of ties beyond their normal life, so that renewals can be made in connection with general surfacing? How long?

Should Be Done

By F. E. Clemons

Foreman, System Track Force, Chesapeake & Ohio, Ashland, Ky.

Ties should not be renewed in advance of general surfacing, except in cases where it is necessary to do so to insure safe gage. Every tie that is dug in weakens the roadbed, and it follows that the more ties that are dug in, the more damage there will be to the roadbed. I find this practice to be most damaging in stone ballast, but the same type of damage occurs in any ballast when ties are removed in this manner. If the ties used in renewal are 7 in. by 9 in. and are rail cut to a depth of two or three inches, as some of the older softwood ties are, it becomes necessary to dig the old bed down three to four inches to get the new tie in and tamped.

To do this has a harmful effect on the tie bed which has been built up over a period, perhaps of years, and the result is a tie with a bearing on a new bed. This tie will invariably pump, and as it does so it will form a pocket to hold water, and this will soon seep under adjacent ties, eventually causing the track to get muddy and churn. One tie renewed in this manner may affect the ties for a half rail length.

I have noticed in laying rail that after the adzers have cut a uniform rail bearing in all ties, the ties that had been dug in recently were all swinging to such an extent that they had to be nipped up against the rail for spiking, while the older ties, being on a solid bed, did not require nipping. A mixture of solid and loose ties makes poor-riding track, aside from possible damage to the rail. I am in favor of deferring the renewals to permit them to be made in connection with general surfacing where this can be done without detriment to the track, but obviously, it is not wise to defer tie renewals for a long period for any purpose.

Favors Yearly Renewals

By A. N. Reece

Chief Engineer, Kansas City Southern, Kansas City, Mo.

Where renewals with treated ties have been followed for a sufficient period to bring the number of treated ties to more than 75 per cent of all ties in track, it would be possible to follow the group-renewal plan of resurfacing the track and renewing all ties that are not good for one year or more of service. Under such a plan, resurfacing should be carried out every fourth year. Under certain traffic conditions it might be possible to spread this resurfacing to once in five years.

Under such a plan, however, after the second year it would be necessary for the section forces to apply occasional ties, principally at joints; a still larger number the third year; and, if resurfacing were postponed until the fifth year, the fourth year's renewals would be equal to or possibly a little greater than would have been necessary if the spot method of replacements were followed and renewals were made year by year. Unless the resurfacing is carried out during the fifth year, the result would be considerable under-maintenance of ties and either a heavier annual spot

renewal would be required or a continuation of the fifth-year resurfacing.

Personally, I favor the yearly renewal program, because it keeps the tie structure more uniform, allows the ultimate life to be obtained from ties, permits a continuation of better tie support, and will necessitate the resurfacing of the track only over roadbed where conditions make resurfacing necessary at intervals of less than four or five years.

Would Not Defer Renewals

By J. B. Martin
General Inspector of Track, New York Central, Cleveland, Ohio

Based on observation and my own experience, I do not believe that it is either economical or desirable to defer the renewal of ties beyond their normal life. Crossties are a fundamental part of the track and sound ties are of the first importance. Obviously, it will cost less to renew ties while the track is being raised out of face, but if poor ties are allowed to remain in the track for any extended time, they will cause poor surface, rail damage, unsatisfactory riding and other conditions that cannot be improved until they are replaced with sound ties.

Large renewals cannot be made without considerable disturbance to the ballast bed, even in connection with a moderate raise. This brings about uneven settlement and can be corrected only by a considerable expenditure of time and effort. The programming of maintenance work is recommended generally. Such a program should include a consistent schedule of tie renewals, which should preclude the possibility of any considerable number of poor ties accumulating in the track. If general surfacing lifts are made frequently enough the tie renewals that are necessary at that time can be made in connection with this work. Such a program will result in better track and lower unit costs.

Draining Inter-Track Spaces

What provision should be made for draining inter-track spaces after the ballast has been cleaned? Why?

Put in Drains

By Roadmaster

In the old days we seldom bothered about water in the inter-track space, but with the methods of cleaning ballast now in vogue we find that we must provide drainage at many points where it was not formerly considered necessary. In general, these are at sags, at bridge abutments and at highway crossings. In providing drains two things should be kept in mind, namely, that it is essential that they be dependable, and that they be capable of disposing of the water quickly. Any quantity of water standing in the inter-track space is as likely to start a water pocket as if it were under the track.

These essential requirements indicate that the drain must have ample capacity to handle the maximum amount of water needing disposal, and that it shall be properly designed and well maintained. In my experience, a perforated corrugated pipe is entirely satisfactory if properly laid. It should be placed laterally under the tracks and have its outlet in the side ditch, if in a cut, or on the shoulder of the roadbed if on a fill. To facilitate cleaning I would not use a pipe less than 6 in. in diameter, regardless of the amount of water to be disposed of. The pipe should have its inlet enough below the subgrade to permit the placing of a box and grating at the level of the subgrade, with a pit of sufficient depth to catch ballast and other debris that may get through the grating. The gradient in the pipe should be sufficient to insure rapid flow and the outlet, somewhat below the shoulder of the roadbed, should be covered to prevent small animals from getting into it.

Importance Emphasized

By Engineer Maintenance of Way

Removing water from the inter-track space on multiple track lines has always presented a problem to the maintenance forces. The importance of this form of drainage has been emphasized in recent years in connection with the increased amount of ballast cleaning that has been done. Formerly, when only hand methods were available, the ballast in the inter-track space was seldom cleaned or, if cleaning were attempted, only the surface ballast was disturbed, say to the bottom of the ties at most, for the labor involved in casting it out on the shoulder and back again was excessive. As the ballast in the inter-track space was generally so clogged with dirt that it was practically impermeable, the water from this space was allowed to escape laterally through the clean and looser ballast used for raising the track.

With the development of power ballast cleaners, however, it has become possible to clean the ballast in this space to a greater depth, well below the ties, at a cost that makes it economically feasible to do so. Where this is done, the well-compacted ballast under the ties acts as a dam to prevent lateral flow of water that gets into this space from rains, melting snow, etc. If the track is level and no drainage is provided, the water thus entrapped will stand until it is able to seep slowly into the roadbed. If it is on a grade, the water will flow for a surprising distance between the tracks unless it is stopped by a break in the grade, a bridge, a grade crossing or other obstruction.

If the material in the subgrade is sufficiently porous to allow quick seepage, and is of a character that will not hold the water and thus become saturated, probably no action will be required, but there are many miles of lines upon which this method of disposal cannot occur. It becomes important, therefore, that artificial drainage be installed wherever the presence of this water will cause undesirable roadbed conditions.

We have tried several schemes for disposing of the inter-track water, all of which have been successful, although we have found it desirable to make some modifications of the original plans in some of our later installations, principally with respect to the size of the pipe employed. Where the track is level we have laid small lateral pipes at intervals of about 250 ft., using first old boiler tubes, at the level of the inter-track subgrade, and extending them to an outlet slightly below the elevation of the shoulder of the roadbed. This scheme worked satisfactorily at first, but eventually the pipes became clogged and ceased to function.

After some experimental work, in which second-hand wrought-iron and steel pipes of larger diameter were used with substantially the same results, we finally began to use perforated, corrugated pipe and are now getting good results. With the larger pipe, usually 6 in., the intervals between the laterals can be extended to 500 ft. or more, depending on local conditions. Furthermore, these pipes can be set somewhat lower than the elevation of the subgrade and protected with a box and a grating or

screen that will exclude most if not all of the material that gave trouble in the smaller pipes. They are relatively short and of sufficient size to permit cleaning if trouble does occur from material washing in. We have also found it necessary to screen the outlet ends of the pipes or to protect them with cairns of stones to prevent rabbits and other small animals from using them as places of refuge.

Where the track is on a grade the same arrangement will work, although it may sometimes be desirable to put in small retards immediately below the inlets to insure that the water will not over run them and accumulate at some point further down the hill. Ordinarily, the spacing can be somewhat greater on a gradient, although if this is done it may be desirable in some cases to use 8-in. pipe for the drains. To insure against possible accumulations of water at the break in the grade by reason of possible failure of some of the drains to function when most needed, or to care for extraordinary rains, we have in some instances shortened the intervals between the pipes near the foot of the hill. We also place similar drains at the low point in the gradient, and immediately above grade crossings and bridge abutments.

It should be understood that elaborate provision for drainage is not always necessary. In this discussion I have attempted to outline our procedure where water in the inter-track space has given the most trouble. In many cases a single drain at the break in the grade, or immediately above bridges or crossings will be ample. The thing to emphasize is that sufficient drainage should always be provided to keep the inter-track space dry.

Painting Concrete Surfaces

Is it practicable to paint concrete surfaces with linseed-oil paints? If not, why? If so, what precautions should be observed?

Can Be Done Successfully

By E. C. Neville
Bridge and Building Master, Canadian National, Toronto, Ont.

Concrete surfaces can be painted successfully with linseed-oil paints under suitable conditions and by using paints that are mixed properly. Concrete retains moisture for a considerable time, for which reason new concrete should not be painted with oil paints for at least a year if best results are desired, since the moisture will ultimately cause the paint to peel. When painting a concrete surface it is advisable to use boiled linseed oil in preference to the raw oil for it is not affected so readily by moisture and it dries more rapidly. If it becomes necessary to use the raw oil, one-fourth pint of drier and one quart of turpentine should be used to the gallon of paint.

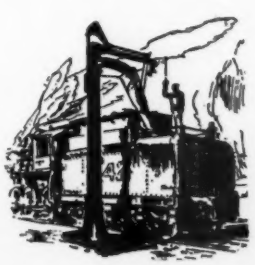
It is just as important that concrete surfaces be prepared properly as those of wood or metal, that is, they should be completely dry and free from dust, dirt and grease. If a concrete surface that is to be painted has a tendency to dust, the condition can usually be remedied by applying two coats of boiled linseed oil and turpentine, using two parts of oil to one of turpentine, giving ample time for the first coat to dry before the second one is applied.

There are many cement paints on the market, which are claimed to be designed especially for painting concrete and which are recommended highly for the purpose, particularly where the concrete has not had time to become thoroughly cured before painting, or where there is danger of moisture appearing behind the paint.

The Answer Is Yes

By A. J. Boase
Manager Structural Bureau, Portland Cement Association, Chicago

Based on the excellent performance of oil paints on many concrete structures of various types, the answer to this question is yes. If the concrete is in suitable condition for receiving the paint and the painting is done properly, the paint should have the same life as on wood, steel or other materials. Oil paints are formulated to provide a coating which will dust off in time, thus making the surface suitable for repainting. Paint coats should not peel off, for the behavior of paint on concrete surfaces should be the same as it is on other materials.



New concrete contains a large amount of moisture and is alkaline. Concrete should be dry when an oil paint is applied. Again, alkali may cause saponification of the oil, causing disintegration of the paint film. Upon exposure to the air, however, the alkaline hydroxides are carbonated and will not effect the oil. Ample time should be given, therefore, to allow for drying and carbonation of the green concrete before an oil paint is applied. Obviously, the exact time required for this will depend on the conditions prevailing on the job. In the case of buildings, at least two or three months should be allowed if possible, and longer periods of drying are desirable. Aged concrete should be clean and dry.

It is fairly common practice to apply a neutralizing wash before painting. Whether this is necessary has never been settled satisfactorily. It is doubtful whether there is any advantage in or necessity for the wash on old concrete, but it is an extra precaution for new concrete, and there are no disadvantages in its use. The solution consists of 2 to 3 lb. of zinc sulphate crystals dissolved in a gallon of water, and a small amount of pigment may be added so that one can easily see where it has been applied. At least 48 hours should be allowed for drying, and when thoroughly dry any crystals that may have formed on the surface should be brushed off with a stiff brush.

The number of coats to be applied will depend on the porosity of the concrete. Two coats may be sufficient on dense concrete, while on porous surfaces such as some of the stuccos, three or even more may be necessary. It is essential that the affinity of the masonry for the oil shall be satisfied before the final coat is applied, so that the oil will not be pulled out of this coat, leaving a weakened film to sustain the pigment. Priming coats should be well thinned with turpentine to insure good penetration. The density of the primed surface should be as nearly uniform as possible before the final coat is applied.

It is not advisable to apply oil paints to walls if moisture can enter from behind. The impermeable film of paint may then be pushed off of the surface by the moisture. To prevent infiltration of water, retaining walls and similar structures should be treated on the back side with a waterproofing coat before they are painted.

New and Improved Products

Hydraulic Jack for Track Inspection

A NEW light weight compact hydraulic jack, designed specially for track inspectors, has been perfected by the Buda Company, Harvey, Ill. The jack consists of a movable cylinder mounted on a fixed piston which is affixed to a base 5½ in. in diameter. The cylinder is raised by hydraulic pressure and has a toe lift at the bottom and grooves on the top to provide a grip against the rail when used for lining or other purposes. A socket for a 20-in. lever is attached to a small piston near the base and the operation of this lever raises the jack. The grooves at the top of the jack are placed at an angle, permitting the lever to be worked a full arc clear of obstruction from the track or the jack parts.

The jack weighs only 20½ lb. complete with the 20-in. lever, has a full rise of 6¼ in., and a low overall height of 11 in. When the jack is in lowered position the top of the toe lift is 2 in. above the bottom of the jack and when fully raised the total height is 17¼ in. The jack is designed primarily as a portable unit for light work, which can be operated easily by one man. It is said that the force on the end of the lever necessary to lift an average rail is but 39 lb.

The Buda Hydraulic Jack for Track Inspectors

New Metal Pile Shoe

A NEW type of steel shoe for wood piles has been placed on the market by the Union Metal Manufacturing Co., Canton, Ohio, to protect the end of the pile and prevent it from brooming when being driven. The shoe is diamond pointed in shape and made of two sections of heavy gage rolled steel electrically-welded together. It is available in two sizes to fit piles with tip diameters ranging from 5 to 14 in., and is attached to the roughly-sharpened end of the pile by means of nail holes in each wing. The wings can be easily bent with a hammer to conform to the shape of the small diameter pile tips. It is stated that the use of these tips not only prevents the ends of the piles from brooming when driven through shale, gravel, rip-rap, rock, or difficult soil conditions, but also enables the piles to be driven further in much less time under such difficult conditions.

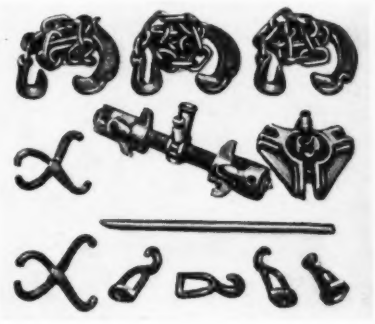
The New Metal Pile Shoe

Push and Pull Jack Has Many Purposes

TEMPLETON, Kenly & Company, Chicago, has developed a multiple tool which it has named the Util-A-Tool, consisting of a push and pull screw jack, together with chains, sky hooks and accessories, which adapt it for such purposes as spreading or pulling together structural members, pushing, hoisting, lifting, lowering, clamping, bracing and tensioning.

The Util-A-Tool consists of a steel screw with smooth machine-cut threads with right hand threads on one end and left hand threads on the other end. On the center of the screw a collar with a ratchet socket in which a bar handle may be inserted provides the means of turning the screw. On each end of the screw are mounted two similar cast steel heads, which are provided with hooks and toes for clamping or spreading work and for attaching the various accessories.

Some of the practical applications of such a tool are: it can spread or pull together rails; it can be used to clamp or hold parts, assemblies or bridge members up to ten-ton loads so that they can be bolted, riveted or welded; it can be used to free jammed ballast car or coal car gates or to open stuck car doors; it can be used to straighten bent coal car gates. The tool is also equipped to remove wheels, pulleys, or gears and can be used as an ordinary screw jack by inserting it vertically in a base provided for that purpose.



The Util-A-Tool and Accessories

Util-A-Tool is available in five sizes and is sold in a compact metal carrying case complete with all accessories and containing instructions and suggestions for its use.

Two Util-A-Tool Push and Pull Jacks Holding Steel Beams in Position for Welding

Elastic Rail Spike—The Elastic Rail Spike Corporation, New York, has issued a four-page illustrated folder setting forth the advantages of the elastic spike. The folder also contains a list of the installations on various railroads of this spike that have been made to date.

NEWS of the Month

Six Months Net Deficit Was $91,766,000

In the first six months of 1939, the Class I railroads of the United States had a net deficit of $91,766,000 after fixed charges, as compared to a net deficit of $180,021,000 in the first half of 1938, the Association of American Railroads announced on August 24. The net deficit for June was $1,685,000, as compared to $15,740,000 in June, 1938.

Higher Average Freight Train Speeds in First Half

In the first six months of 1939, the railroads of the United States established a new high record in the average speed of freight trains. This average speed was 64.1 per cent higher than in the corresponding period in 1920, and during the first six months of 1939 the average distance traveled per train per day was 405 miles, compared with 400 miles in 1938 and 247 miles in 1920.

Big Four Foremen Hold Annual Meeting

Nearly 150 members and guests attended the seventeenth annual convention of the Association of Maintenance of Way Foremen of the Big Four, at Chicago on August 25. Supplementing a program of reports and discussions, the meeting was addressed by F. W. Hillman, assistant engineer of maintenance on the Chicago & North Western, who spoke in place of B. R. Kulp, engineer of maintenance, who was unable to be present, and W. E. Fuller, assistant to vice-president on the Chicago, Burlington & Quincy.

Congress Adjourns—Only Minor Railroad Bills Passed

On August 5, congress adjourned without taking final action on important transportation legislation. Only two bills were passed by this session; one a bill to aid voluntary reorganizations under certain conditions, applicable principally to the Baltimore & Ohio and the Lehigh Valley, was passed and signed by President Roosevelt, the other a bill which would have relieved the railroads of a part of the cost of reconstructing bridges required to be altered in connection with waterway improvements, was passed but later vetoed by the President. However, "fairly comprehensive" general transportation legislation was passed by both houses of congress and final action on a conference report is expected to be worked out for adoption early in the next session, according to the Association of American Railroads.

Vandals Wreck "City of San Francisco"

The first major derailment of a high-speed, lightweight streamlined train occurred on the Southern Pacific at 8:33 p.m. on August 12, when the City of San Francisco, westbound 17-car streamliner operated jointly by the Chicago & North Western, the Union Pacific and the Southern Pacific from Chicago to San Francisco, Cal., was derailed about 1¼ miles east of Harney, Nev., killing 9 passengers and 15 members of the crew, and injuring 108 persons. Immediately after the accident, it was found that an angle bar had been removed and the end of one rail had been moved without breaking the bond wires, and respiked in a position four inches toward the center of the track. The rail that was moved was located on a curve 170 ft. east of the Humboldt River bridge and the rail end had been covered with weeds. At the same time two lining bars were found near the accident.

Regarding the derailment, A. D. McDonald, president of the Southern Pacific, stated, "All the evidence points to the fact that the wrecking of the streamliner was planned with craft and deliberation—the rail in the tracks where the accident occurred was of 130-lb. weight per yard—and was in perfect condition. The track was heavily ballasted with crushed rock. The ties were in first class condition—despite the use of all protective devices and mechanical safeguards and despite constant vigilance of inspection, we were powerless to prevent the act that sent the City of San Francisco to disaster."

Tie Renewals in 1938

Data compiled by the American Railway Engineering Association's Committee on Ties from statistics covering the tie renewals of 136 class I roads of the United States, reveal that 39 railways renewed more ties per mile of main track in 1938 than in 1937, while 96 roads inserted less ties, and one road applied the same number in both years. Treated ties were applied exclusively on 36 roads, and on 44 roads more than 80 per cent of the ties used were treated. On many of the latter all new ties inserted were treated, the remainder being second hand ties salvaged from abandoned tracks. Only 12 roads used no treated ties; on 5 the treated ties ranged from negligible to 20 per cent; 8 inserted 20 to 40 per cent; on 21 roads treated ties represented 40 to 60 per cent and on 12 roads the percentage ranged from 60 to 80.

Auto Manufacturers Ship Mostly by Highway

In 1938, highway carriers transported 54.9 per cent of the new passenger automobiles shipped from factories and assembly plants, while the railroads transported 37.7 per cent and the waterways 7.4 per cent, according to a two-page exhibit made public by the Interstate Commerce Commission on August 17. Of the Big Three of the automobile industry, General Motors used the railroads for 48.6 per cent of its shipments, Chrysler shipped 36.7 per cent by rail and Ford transported only 20 per cent by rail.

Seaboard to Substitute Trucks for L.C.L. Service

An arrangement whereby the Seaboard Air Line will substitute truck service for its existing L.C.L. freight service between various stations on a large part of its system has been approved by Division 5 of the Interstate Commerce Commission. The truck schedules will be coordinated with the regular train service from important origins and will expedite delivery as much as 36 hr. in some instances. Also the railroad anticipates substantial savings in fuel because of the elimination of train stops and the reduction in the number of cars in local trains.

Patterson Appointed A Director of I.C.C.

William J. Patterson, director of the Bureau of Safety of the Interstate Commerce Commission, has been appointed by President Roosevelt to be a member of the commission for a term expiring December 31, 1945. Mr. Patterson succeeds former Commissioner Balthaser H. Meyer, whose term expired last December 31, and whom President Roosevelt first sought to replace with Thomas R. Amlie, left wing Wisconsin progressive and former member of the House of Representatives, as reported in the February and May issues of *Railway Engineering and Maintenance*. Mr. Patterson was confirmed by the Senate on July 27 and took the oath of office on July 31.

Association News

Bridge and Building Supply Men's Association

Nineteen companies have now arranged to participate in the exhibit to be presented at the Hotel Stevens, Chicago, on October 17-19, concurrently with the convention of the American Railway Bridge and Building Association. The following companies have arranged for space, in addition to those reported in the August issue, page 492. Further applications should be addressed to W. S. Carlisle, secretary, care of the National Lead Company, 900 West 18th Street, Chicago.

American Lumber & Treating Co., Chicago
Dearborn Chemical Co., Chicago
Detroit Graphite Co., Detroit, Mich.
Massey Concrete Products Corp., Chicago
National Lead Co., New York
Oxweld Railroad Service, Chicago
U. S. Wind Engine & Pump Co., Batavia, Ill.

Bridge and Building Association

A meeting of the members of the Executive committee and chairmen of committees was held in Chicago on August 7 with President Armstrong Chinn, Vice-Presidents F. H. Cramer, A. E. Bechtelheimer, H. M. Church and R. E. Dove, Secretary-Treasurer C. A. Lichty, Director F. H. Soothill, Past-Presidents C. M. Burpee and Elmer T. Howson, and Committee Chairmen S. T. Corey, R. W. Johnson, M. P. Walden and H. B. Christiansen, in attendance. President K. T. Batchelder and Secretary W. S. Carlisle of the Bridge and Building Supply Men's Association were also present for part of the day. Primary consideration was given to the formulation of the program for the 46th annual convention, which will be held at the Hotel Stevens, Chicago, on October 17-19, after which reports of all of the committees were presented to and passed upon by the Executive committee. The completion of all of the eight committee reports at this early date insures a convention of high technical standing.

American Railway Engineering Association

Only one committee of the Association held a meeting during August, this being the Committee on Water Service, Fire Protection and Sanitation, which met in Chicago on Aug. 15, but September promises to be an active month as nine committees have scheduled meetings in different parts of the country. Five of these committees, all interested in matters pertaining to roadway and track, will hold their meetings in Chicago at the time of the annual convention of the Roadmasters and Maintenance of Way Association. These committees and the dates of their meetings are as follows: Roadway and Ballast, September 19 and 20; Maintenance of Way Work Equipment, September 19; Rail, September 20; Economics of Railway Labor, September 20; and Track, September 21. Other committees that have already scheduled meetings in September are those on Records and Accounts, which will meet in New York the middle of September; Rules and Organization, which will meet in New York on September 29; Economics of Railway Location and Operation, which will meet in New York on September 28 and 29; and Yards and Terminals, which will meet in Roanoke, Va., on September 25 and 26.

Late in August, the secretary's office mailed to members of the Association who are holders of the Manual, the loose-leaf supplement which contains the additions to and revisions of the Manual adopted at the convention last March.

Track Supply Association

A total of 44 companies have now arranged to participate in the 25th annual exhibit of the Track Supply Association, which will be presented concurrently with the Roadmasters and Maintenance of Way Association at the Hotel Stevens, Chicago, on September 19-21. These companies have arranged to take 62 spaces, assuring an exhibit of the same or slightly larger size than last year. Further applications for space should be addressed to Lewis Thomas, secretary-treasurer, care of the Q & C Company, 59 East Van Buren St., Chicago.

The companies which have arranged for space to date are as follows:

Air Reduction Sales Co., New York
Alcoma Railway Equipments, Chicago
American Fork & Hoe Co., Cleveland, Ohio
Armco Railroad Sales Co., Middletown, Ohio
Barco Manufacturing Co., Chicago
Buda Co., Harvey, Ill.
Creepcheck Co., Inc., New York.
Crerar, Adams & Co., Chicago
Cullen-Friestedt Co., Chicago
A. P. deSanno & Son, Inc., Phoenixville, Pa.
Duff-Norton Manufacturing Co., Pittsburgh, Pa.
Eagle Grinding Wheel Co., Chicago
Elastic Rail Spike Corp., New York
Electric Tamper & Equipment Co., Ludington, Mich.
Fairmont Railway Motors, Inc., Fairmont, Minn.
Hayes Track Appliance Co., Richmond, Ind.
Illinois Malleable Iron Co., Chicago
Jacobsen Manufacturing Co., Racine, Wis.
O. F. Jordan Co., East Chicago, Ind.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Link-Belt Speeder Corp., Chicago
Lundie Engineering Corp., New York
Maintenance Equipment Co., Chicago
Mall Tool Co., Chicago
Metal & Thermit Corp., New York
Morden Frog and Crossing Works, Chicago
Nordberg Manufacturing Co., Milwaukee, Wis.
Northwestern Motor Co., Eau Claire, Wis.
Oxweld Railroad Service Co., Chicago
P. & M. Co., Chicago
Pettibone Mulliken Corp., Chicago
Pocket List of Railroad Officials, New York
Positive Rail Anchor Co., Chicago
O & C Co., New York
Rail Joint Co., Inc., New York
Rails Co., New Haven, Conn.
Railway Engineering and Maintenance, Chicago
Railway Track-Work Co., Philadelphia, Pa.
Ramapo-Ajax Division of the American Brake Shoe & Foundry Co., New York
Reade Manufacturing Co., Jersey City, N. J.
Templeton, Kenly & Co., Ltd., Chicago
Warren Tool Corp., Warren, Ohio
Woodings Forge & Tool Co., Verona, Pa.
Woolery Machine Co., Minneapolis, Minn.

Roadmasters Association

Plans for the 54th annual convention of the Roadmasters and Maintenance of Way Association, which will be held at the Hotel Stevens, Chicago, on September 19-21, are now approaching completion and the interest that is being shown indicates that the meeting will be one of more than usual value. The program is as follows:

Tuesday, September 19

Morning Session—10 a.m.

Convention called to order.

Opening address by C. E. Johnston, chairman, Western Association of Railway Executives, Chicago

Greetings from the American Railway Engineering Association, E. M. Hastings (chief engineer, R. F. & P.), President

Greetings from the American Railway Bridge and Building Association, Armstrong Chinn (chief engineer, Alton), President

Greetings from the Track Supply Association, Lem Adams (vice-president, Oxweld Railroad Service Co.), President

Address by President F. B. Lafleur (roadmaster, Sou. Pac. Lines, Lafayette, La.)

Report of Committee on Heaving Track, Its Causes, Control and Maintenance; L. J. Gilmore, chairman (roadmaster, G. N., Superior, Wis.)

Afternoon Session—2 p.m.

Report of Committee on The Roadmaster's Qualifications and Duties; J. M. Miller, chairman (division engineer, W. M., Cumberland, Md.)

Address on The Practice of Safety in Maintenance of Way Work, by R. H. Smith, vice-president and general manager, N. & W., Roanoke, Va.

Adjournment to visit exhibit of Track Supply Association

Tuesday Evening—8 p.m.

Moving pictures—Locomotive slip test films taken by the C. B. & Q., showing the effect on track of locomotives operating at high speeds

Wednesday, September 20

Morning Session—9:30 a.m.

Report of Committee on The Maintenance of Curves; C. W. Baldridge, chairman (asst. engineer, A. T. & S. F., Chicago)

Address on High-Speed Trains and Track Maintenance, by W. H. Hillis, engineer maintenance of way, C. R. I. & P., Chicago

Report of Committee on Anchoring Track to Meet Present-Day Conditions; J. J. Clutz, chairman (supervisor, Penna., Trenton, N.J.)

Afternoon Session—2 p.m.

Report of Committee on The Utilization of Roadway Machines; H. E. Kirby, chairman (assistant engineer, C. & O., Richmond, Va.)

Address on Recent Trends in Rail Manufacture and Maintenance and Their Effects on Track Work, by C. B. Bronson, inspecting engineer, N. Y. C. System, New York

Question Box—For the discussion of practical questions on track maintenance submitted from the floor

Adjournment to visit exhibit of Track Supply Association

Wednesday Evening—6:30 p.m.

Annual dinner given by Track Supply Association

Thursday, September 21

Morning Session—9:30 a.m.

Report of Committee on Specialized Versus Section Gangs; J. B. Kelly, chairman (general roadmaster, M. St. P. & S. S. M., Stevens Point, Wis.)

Closing Business

Thursday Afternoon

The members will visit the mills of the Inland Steel Company at Indiana Harbor, Ind., to observe the manufacture of bolts, spikes and tie plates.

Personal Mention

General

J. E. Griffith, supervisor of track of the Southern, with headquarters at Charlottesville, Va., has been promoted to trainmaster at Charleston, S.C.

Clark Hungerford, an engineer by training and experience, whose promotion to general manager, Western Lines, of the Southern, with headquarters at Cincinnati, Ohio, was noted in the August issue, was born on December 22, 1899, at Jackson, Tenn., and graduated from Princeton University in 1922. He entered the service of the Southern on October 28, 1918, serving as transitman, junior engineer and coal chute foreman during summers while attending school. On December 1, 1922, he was appointed bridge inspector at Charlotte, N.C., which position he held until April 16, 1924, when he became an engineer and draftsman in the office of the chief engineer maintenance of way

Clark Hungerford

and structures. On July 1 of that year he was promoted to assistant engineer, with headquarters at Knoxville, Tenn., and on March 16, 1925, was appointed assistant trainmaster on the Asheville division, with headquarters at Asheville, N.C. A year later he was appointed trainmaster of the Atlanta division, with headquarters at Macon, Ga., and on July 1, 1927, was transferred to the Charlotte division, with headquarters at Charlotte, N.C. On October 1, 1927, he was promoted to superintendent of the Mobile division, which position he held until February 7, 1929, when he was transferred to the Georgia, Southern & Florida at Macon. On February 10, 1934, he was transferred to the Washington division, with headquarters at Alexandria, Va., and on February 1, 1936, to the Birmingham division.

George H. Warfel, formerly a division roadmaster on the Union Pacific, has been promoted to superintendent of the Kansas division, with headquarters at Kansas City, Mo. Mr. Warfel was born at Ladoga, Ind., on March 28, 1884, and entered railway service on August 15, 1901, as a laborer in the signal department of the Union Pacific. He later became successively a batteryman, repairman and a maintainer. He resigned in August, 1904, to take charge of the electric light plant in Ladoga, and the following year he went with the Hall Signal Company, Chicago, as a gang foreman. On January 10, 1906, he returned to the Union Pacific as a signal maintainer at Point of Rocks, Wyo., and in June, 1907, he was promoted to district signal foreman at Laramie, Wyo. Mr. Warfel was appointed assistant roadmaster at Kearney, Neb., in March, 1910, and was promoted to roadmaster at that point in 1912. In May, 1926, he was promoted to general roadmaster, with headquarters at Kansas City, Mo., and in November of that year he was transferred to Omaha, Neb. On January 1, 1927, he was promoted to assistant to the general manager, in charge of safety, at Omaha, and in February, 1935, he was advanced to assistant superintendent of the Nebraska division, with headquarters at North Platte, Neb. Mr. Warfel was promoted to superintendent of the Wyoming division, with headquarters at Cheyenne, Wyo., in February, 1937. He was later appointed assistant superintendent at North Platte, and on March 14, 1939, he was appointed acting superintendent at Kansas City, the position he held at the time of his recent promotion.

Engineering

S. H. Poore, chief draftsman in the office of the engineer maintenance of way of the Chesapeake & Ohio, has been promoted to assistant division engineer of the Richmond division, with headquarters at Richmond, Va., succeeding **H. S. Talman,** transferred.

H. H. Tripp, division engineer on the Canadian Pacific, with headquarters at Edmonton, Alta., has been transferred to Fort William, Ont., succeeding **K. A. Dunphy,** who has been transferred to Winnipeg, Man., relieving **V. H. Carruthers,** who in turn has been transferred to Edmonton replacing Mr. Tripp.

Willis H. Lowther, whose promotion to division engineer on the Union Pacific, with headquarters at Spokane, Wash., was announced in the June issue, was born in Colorado Springs, Colo., on November 23, 1886, and graduated from the College of Engineering of Colorado University in 1909. He entered railway service on September 1, 1911, on the Oregon Short line, a subsidiary of the Union Pacific, and from December, 1911 to March, 1912, served as a levelman on location. On the latter date, he was made an instrumentman on construction and in November, 1912, he was promoted to office engineer for the Oregon-Washington Railroad & Navigation Company (part of the Union Pacific system). Mr. Lowther was promoted to division engineer in May, 1913, and in January, 1915, he returned to the Oregon Short line as assistant engineer, maintenance. In January, 1917, he was appointed engineer accountant and assistant to the engineer of maintenance of way and the following August, he was promoted to division engineer, maintenance, of the Idaho division. He was transferred to the Central division in September, 1919, and to the Colorado division in October, 1920. Mr. Lowther left railroad service in March, 1925, to become engineer of flood control for the city of Denver, but returned to the Union Pacific in January, 1926, as division engineer of the Wyoming division, with headquarters at Cheyenne, Wyo. In the latter part of 1931, he was transferred to Green River, Wyo., and early in 1936, his headquarters were transferred back to Cheyenne. Mr. Lowther was later appointed assistant engineer at Ketchum, Idaho, the position he held at the time of his recent promotion.

William Sinclair Burnett, chief engineer of the Cleveland, Cincinnati, Chicago & St. Louis (Big Four), with headquarters at Cincinnati, Ohio, has retired because of ill health and his duties have been assumed by **Paul Hamilton,** assistant chief engineer, without change of title.

Mr. Burnett was born at Montrose, Scotland on September 5, 1878, and graduated from the East of Scotland Technical College. After completing his education, Mr. Burnett came to the United States and entered railway service as a rodman on the Southern Indiana (now part of the Chicago, Milwaukee, St. Paul

William Sinclair Burnett

& Pacific), being promoted to instrumentman in 1900. In 1904, he was appointed resident engineer on the Chicago Southern (now part of the Chicago & Eastern Illinois). He entered the service of the Big Four in 1906, as a resident engineer at Mt. Carmel, Ill., going with the C. M. St. P. & P. in the same capacity two years later. In 1910, Mr. Burnett returned to the Big Four as a resident engineer and served in that capacity at Evansville, Ind., Sharonville, Ohio, and Bellefontaine. In 1912, he was promoted to district engineer, with headquarters at Middletown, Ohio, and the following year he was advanced to division engineer maintenance of way, with headquarters at Springfield, Ohio. Later he was appointed district engineer at Springfield and in 1924, he was promoted to engineer of construction, with headquarters at Cincinnati. Mr. Burnett was further advanced to chief engineer of construction on June 1, 1925, and on January 16, 1932, he was promoted to chief engineer, the position he held until his retirement on August 1.

Charles Harry Fox, engineer of water service on the Canadian Pacific, with headquarters at Winnipeg, Man., has been

promoted to district engineer, with headquarters at Moose Jaw, Sask., succeeding **J. V. McNab,** who has taken an extended leave of absence because of poor health, and **Charles K. Holden,** roadmaster at Grand Forks, B.C., has been advanced to engineer of water service at Winnipeg, relieving Mr. Fox.

Mr. Fox was born at Winnipeg, Man., on April 2, 1885. He entered railway service in 1902 as a clerk in the construction department of the Canadian Pacific at Winnipeg and in 1903, he was appointed a rodman in the maintenance engineering department at Brandon, Man. From 1905 to 1910, he attended McGill University, where he obtained a master of science degree in civil engineering in 1910, serving during the summer months as an instrumentman. Later he was employed as a resident engineer on construction work, and was appointed resident engineer in the maintenance department at Fort Williams, Ont., following his

Charles Harry Fox

graduation. From 1912 to 1915, he was assistant division engineer of the Manitoba division, with headquarters at Winnipeg and in the latter part of 1915 he was promoted to division engineer at Winnipeg, continuing in that capacity until 1918, when he entered military service. Mr. Fox returned to the Canadian Pacific in 1919 as division engineer of the Regina and Saskatoon divisions. In 1920, he was advanced to assistant district engineer, with headquarters at Winnipeg, and in 1921, he was reappointed division engineer at Winnipeg. Mr. Fox was promoted to engineer of water service, with headquarters at Winnipeg in May, 1923, the position he held until his recent promotion.

Mr. Holden was born at Winnipeg on March 31, 1904, and graduated in civil engineering from the University of Manitoba in 1927. He entered railway service between terms of school as a temporary rodman on the Portage division on May 17, 1923, and served during the summer of 1925 and following summers while attending college as a temporary transitman on the Portage division. On October 5, 1927, he was appointed a levelman on location work in Northern Alberta and on February 6, 1928, he was appointed a transitman on the Portage division. Mr. Holden was transferred to the Kenora division on February 19, 1931, and on June 1, 1932, he returned to the Portage division. On January 1, 1935, he was promoted to roadmaster of the La Riviera subdivision, with headquarters at Winnipeg. On December 1, 1938, he was transferred to the Keewatin subdivision, with headquarters as before at Winnipeg, and on January 15, 1939, he was transferred to the Boundary subdivision, with headquarters at Grand Forks, B.C., where he was located until his recent promotion.

Track

L. W. Hollifield, section foreman on the Louisville & Nashville, has been promoted to track supervisor at Corbin, Ky., succeeding **I. C. Eads,** who has retired.

G. E. Butler has been appointed assistant roadmaster on the Pulaski district of the Norfolk & Western, with headquarters at Pulaski, Va., succeeding **R. F. Alley,** transferred.

R. W. Lucas, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Estherville, Iowa, has been transferred to Manly, Iowa, replacing **P. I. Buser,** who has been transferred to Estherville, relieving Mr. Lucas.

J. E. Swanson, roadmaster on the Union Pacific at Cheyenne Wells, Colo., has been promoted to general roadmaster, with headquarters at Cheyenne, Wyo., succeeding **O. H. Carpenter,** who has been appointed roadmaster at Rawlins, Wyo., and **W. T. Bret,** section foreman, has been promoted to roadmaster at Cheyenne, Wyo.

H. A. Harnish, track supervisor on the Colorado & Southern, has been promoted to roadmaster, with headquarters at Trinidad, Colo., succeeding **A. G. Reese,** whose promotion to engineer maintenance of way of the Colorado & Southern, the Fort Worth & Denver City and the Wichita Valley, with headquarters at Denver, Colo., was announced in the August issue.

J. D. Henley, assistant supervisor of track on the Southern, at Charlotte, N.C., has been promoted to supervisor of track, with headquarters at Keysville, Va., to succeed **H. C. Mauney,** who has been transferred to Richmond, Va. Mr. Mauney replaces **H. C. Fox,** who has been transferred to Spartanburg, S.C., to relieve **W. C. Radford,** who goes to Chester, S.C., in the same capacity. Mr. Radford succeeds **W. B. Bailes,** who has been transferred to Charlottesville, Va., where he replaces **J. E. Griffith,** whose promotion to trainmaster is noted elsewhere in these columns.

Frank Aikman, assistant supervisor of track on the Pennsylvania at Wilmington, Del., has been promoted to supervisor of track at Carrothers, Ohio. **H. W. Seeley, Jr.,** has been appointed assistant supervisor of track on the Williamsport division at Lock Haven, Pa., to succeed **M. B. Jamin,** who has been transferred to the Maryland division at Wilmington, to replace Mr. Aikman. **J. E. Chubb** has been appointed assistant supervisor of track on the Philadelphia division at Harrisburg, to succeed **C. F. Parvin,** who has been transferred to the Philadelphia division at Lancaster, Pa.

C. G. Johnson, extra gang foreman on the Kettle Valley division of the Canadian Pacific, has been promoted to roadmaster at Grand Forks, B.C., succeeding **C. K. Holden,** whose promotion to engineer of water service at Winnipeg, Man., is announced elsewhere in this issue. **A. J. G. Murdoch,** roadmaster at Assiniboia, Sask., has retired and **J. Bain,** roadmaster at Regina, Sask., has resigned. **A. Swanson,** roadmaster at Strasbourg, Sask., has been transferred to Regina, succeeding Mr. Bain and **A. Campbell,** roadmaster at Saskatoon, Sask., has been transferred to Strasbourg, replacing Mr. Swanson. The roadmasters positions at Assiniboia and Saskatoon have been discontinued and territories redistributed.

Bridge and Building

N. B. Sears, bridge and building foreman on the Chicago, Rock Island & Pacific at Ottawa, Ill., has been promoted to acting master carpenter, with headquarters at Rock Island, Ill., succeeding **G. E. Brooks,** who retired on August 1.

Obituary

Eldridge E. Candee, who retired in 1930, as supervisor of bridges and buildings on the New York, New Haven & Hartford, after 45 years of active service with that road, died at the age of 79 on August 11, in New Haven, Conn.

Charles Weedon Cochran, at one time division engineer maintenance of way of the Cleveland, Cincinnati, Chicago & St. Louis, whose death on May 26 was noted in the August issue, was born in Winchester, Va., on December 4, 1876, and was graduated from the Virginia Polytechnic Institute in 1898. Mr. Cochran went with the C. C. C. & St. L. in June, 1899, as a rodman, advancing in 1901 to locating engineer; in 1902 to resident engineer; in 1907 to assistant engineer maintenance of way of the Cleveland division; and in 1909 to supervisor of the First district. He was then made assistant division engineer maintenance of way, and in April, 1912 was appointed engineer maintenance of way of the Michigan division, with headquarters at Wabash, Ind., later being transferred to Mt. Carmel, Ill., and Galion, Ohio. In 1917 he left railway service to enter the United States army as a captain in the office of the Chief of Engineers and in September, 1918, he was promoted to the rank of Major of Engineers. In 1924, he was appointed examiner in charge of the Bureau of Valuation, Interstate Commerce Commission, for the Eastern territory, with headquarters at Philadelphia, Pa., remaining in the service of the Commission until his death.

T. P. O'Neill, engineer maintenance of way of the Colorado & Southern, the Fort Worth & Denver City and the Wichita Valley, with headquarters at Denver, Colo., whose sudden death on July 6, was announced in the August issue, was born at St. Catherine, Mo., on April 20, 1883, and attended Christian Brothers College at St. Louis, Mo. He entered railway service in 1899, prior to attending college, as a section laborer on the Chicago, Burlington & Quincy, in which position he served for four years. He was employed

Smooth

is the word for

RAIL JOINTS held with BETHLEHEM TRACK BOLTS

RAIL joints held with Bethlehem Track Bolts suit the sleek, shining smoothness of speeding streamliners, stand up under the pounding of heavy freights, the jolt and batter of light traffic.

The strength and tenacity of Bethlehem Heat-treated Bolts and Hot-forged Nuts fit them for the hardest rail joint service. They hold the rails to rigid, accurate alignment. The rail joint assembly stays tight, end batter and low joints are kept at a minimum and maintenance costs are materially reduced.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY

in the engineering department of the Burlington from 1906 to 1910, and in the engineering department of the Kansas City Terminal from 1911 to 1914. He was assistant engineer for the Wyandotte Construction Company in 1915, re-entering railway service as an instrumentman on the Kansas City Southern in 1916. Later in the same year Mr. O'Neill was made an assistant engineer on the Burlington, remaining in that position until 1921, when he was appointed roadmaster on the Kansas, Oklahoma & Gulf. He was appointed assistant engineer maintenance of way on the Burlington, with headquarters at Alliance, Neb., in 1923, and in August 1926, he was promoted to engineer maintenance of way of the Colorado & Southern, with headquarters at Denver, Colo. In December, 1938, Mr. O'Neill's jurisdiction was extended to include the Fort Worth & Denver City and the Wichita Valley, with the same headquarters.

Supply Trade News

General

The National Aluminate Corporation is constructing a 105-ft. by 128-ft., one story addition to its plant at Chicago.

The Link-Belt Company, Chicago, has recently organized the **Link-Belt Speeder Corporation,** a wholly-owned but independently-operated subsidiary, with headquarters at 301 West Pershing road, Chicago, for the manufacture and sale of power-operated excavating and materials-handling shovels, draglines and cranes, including a line of track-type locomotive cranes. This organization follows closely a consolidation of the Speeder Machinery Corporation, Cedar Rapids, Iowa, and the Shovel division of the Link-Belt Company, several months ago. These units now become the Link-Belt Speeder Corporation, Chicago.

Personal

Charles H. Beard has been appointed general traffic manager of the operating companies of the **Union Carbide & Carbon Corporation,** New York.

Kenneth J. Burns, district sales manager of the Youngstown Sheet & Tube Company, Youngstown, Ohio, has been appointed district sales manager of the **Inland Steel Company,** with headquarters in its newly opened district sales office at Cincinnati, Ohio.

C. D. Marshall, chairman of the executive committee of the board of trustees of **Koppers United Company,** resigned July 24. To succeed Mr. Marshall as chairman, the executive committee has elected **J. T. Tierney.** Mr. Tierney also continues as president and Mr. Marshall retains his membership on the board. Mr. Tierney will also be chairman of the board of Koppers Company, resigning his position as president of this principal operating unit of the Koppers organization. He will be succeeded as president of Koppers Company by **J. P. Williams, Jr.,** who for some years has been vice-president of Koppers United Company and president of The Koppers Coal Company. Mr. Williams will serve also as executive vice-president of Koppers United Company.

Emmett J. Fallon, who has been elected president of the **Pettibone Mulliken Corporation,** Chicago, as reported in the August issue, graduated from De Paul University in 1913. Later he organized the

Emmett J. Fallon

Fallon Company and engaged in railroad contracting work until 1929, when he organized and became president of the Union Contracting and Engineering Company, Chicago. In 1935, he was elected vice-president of the Des Moines Foundry & Machinery Company and the Grinnel Washing Machinery Corporation, with headquarters at Chicago, which positions he has held until his recent election.

Philip M. Guba, manager of sales, Chicago district sales office of the **Carnegie-Illinois Steel Corporation** since January, 1938, has been appointed eastern sales

Philip M. Guba

manager, with headquarters at New York and Pittsburgh, Pa. Specifically, he will co-ordinate sales activities of the company in the eastern area, including offices at Boston, Mass., Hartford, Conn., New York, Philadelphia, Pa., Baltimore, Md., and Washington, D.C. Mr. Guba will be succeeded at Chicago by **G. A. Price,** present manager of sales, bar, strip, and semi-finished materials division, general sales department, who in turn will be succeeded by **T. J. Bray, Jr.,** manager of sales Pittsburgh district. **J. G. Armstrong, Jr.,** assistant manager of sales, Pittsburgh district, will succeed Mr. Bray.

Mr. Guba has been connected with sales in the steel industry since 1910. From 1918 to 1933, he was sales official of the Donner Steel Company and later of the Republic Steel Corporation. He began his association with Carnegie-Illinois in March, 1933, as assistant manager of sales at the Detroit, Mich., office, becoming manager of sales there in March, 1935.

Trade Publications

Pipes—Facts about Republic Standard Pipe is the title of a pocket-size 10-page pamphlet known as Bulletin Adv. 316, published by the Republic Steel Corporation, Cleveland, which contains bundling tables, sizes and weights, identification and corrosion information on Republic Standard Pipe, Republic Copper-Bearing Steel Pipe and Toncan Copper Molybdenum Iron Pipe.

Portable Generators—A six-page illustrated folder is being distributed by the Homelite Corporation, Port Chester, N. Y., which is devoted to this company's line of gasoline-engine driven portable electric generators. The folder describes the various sizes of generators that this company manufactures, points out their advantages and shows how they can be applied to various construction and maintenance projects.

Buda Jacks—The Buda Company, Harvey, Ill., has issued bulletin 884-B describing and illustrating its complete line of jacks for railroad service. The bulletin includes tables of specifications and capacity loads and points out the special features of each type of jack. The last page of the bulletin briefly describes a number of other railway products manufactured by this company, including bumping posts, car stops, track drills and switch stands.

Kinnear Rolling Doors—The Kinnear Manufacturing Company, Columbus, Ohio, has issued a 36-page catalogue of its complete line of rolling doors, fire doors and shutters, metal rolling grilles, bifolding doors, door-operating equipment and wood rolling partitions. The catalogue explains the design, construction and operation of these various products and many illustrations of various types of installations for which Kinnear doors and shutters can be used are shown.

American Locomotive Cranes—The 40 and 50 ton locomotive cranes manufactured by the American Hoist & Derrick Co., St. Paul, Minn., are featured in a 16-page catalog known as Bulletin No. 600-L-2 recently issued by this company. These cranes, which may be furnished with either gasoline engine or Diesel power, are described and illustrated. Two pages of the catalog are devoted to tables showing the maximum hook clearance for various radii of booms, and the safe lifting capacity in pounds with and without outriggers for both the 40-ton and the 50-ton cranes with various boom radii. Features of the design and construction of the cranes, including the new three-speed transmission, are also described.

Why Disturb the Bed TO RENEW A TIE!!!

After the old tie is cut in three pieces, the end and center sections are easily lifted out, leaving the FIRM, PERMANENT BASE shown above, on which the new tie is seated. Also note minimum disturbance of crib.

The WOOLERY TIE CUTTER

not only eliminates the necessity for *digging out the ballast* in the crib, but also AVOIDS DISTURBANCE of the COMPACTED BED on which the old tie rested.

The large investment made in the tamping of the old tie is thus conserved and spotty track is avoided, because the usual *retamping* and the *time* required to stabilize the bed under the new tie *are* eliminated.

This is *another* of the many features of the Woolery Tie Cutter that CUT TIE RENEWAL COSTS 30%, saving 12 cents or more on every tie.

Investigate—Send for copy of 12-page booklet—Let us demonstrate on YOUR road.

Eliminate trenching—Speed up renewals—Make the work easier. Machine is light in weight—Can easily be removed from the track by its operator in 10 seconds.

WOOLERY MACHINE COMPANY

MINNEAPOLIS — Pioneer Manufacturers of — MINNESOTA

RAILWAY MAINTENANCE EQUIPMENT

TIE CUTTERS • SWITCH HEATERS • MOTOR CARS

RAILWAY WEED BURNERS • BOLT TIGHTENERS

TO RAILWAY SUPPLY MANUFACTURERS

At the Convention

"Boss, why can't we exhibit our products at the Roadmasters Convention?"* asked the railway sales representative.

"Why should we?" replied the sales manager. "Conventions are nothing but junkets for a lot of railway men who don't go there to see track materials."

"That's where you're dead wrong. Those men take their work seriously. You ought to hear them tear a committee report to pieces on the convention floor. They get down to brass tacks with a vengeance. Why they hardly take time out to eat. And they hold evening sessions too."

"Well, what's that got to do with our exhibiting?"

"Just this, Boss. Those roadmasters—and a lot of engineers attend their meetings too—are just as interested in the materials and devices shown there as they are in the meeting. They spend so much time between sessions in the exhibit that the "peddlers" scarcely get time to eat. They've got to be shown the *how* and *why* of everything."

"That's the kind of men we like to show our products to."

"That's right, and that's the reason that more than 50 of the companies that are most successful in selling track materials participate in this exhibit."

"It begins to look like we ought to exhibit."

"I'm sure of it. And here's another unique feature of this convention. The magazine that these men read, and that their bosses also read from cover to cover—*Railway Engineering and Maintenance*—prints all of the committee reports in a special convention edition, copies of which are handed every man attending the meeting, and the reports are read from these copies on the convention floor. It's the only way in which these reports are available."†

"That's a fine service to the members of the association, but how does it interest us?"

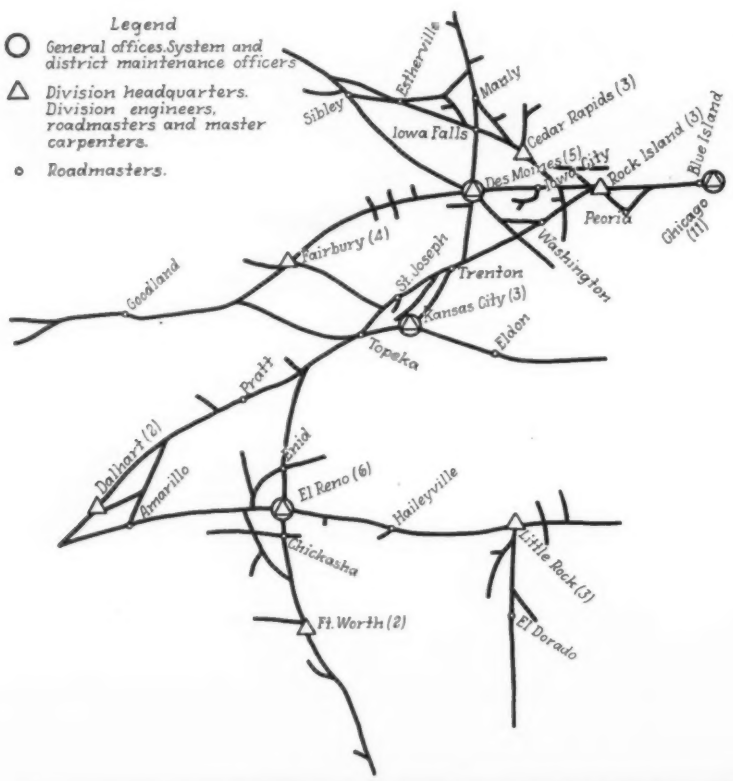
"Just this way, Boss. They include in these copies all of the advertising that'll appear in the final issue carrying the full report of the convention. And these men in the meeting are constantly looking at and studying these ads. It's a fine tie-up with the exhibit."

"In other words, you think that we ought to exhibit at this convention to reach these men who come from all parts of the country—and that we ought also to advertise in the convention edition of *Railway Engineering and Maintenance* in order to complete the job."

"That's what I'm trying to get over to you, Boss."

"It looks like a good idea. We'll do both."

"You'll have to hurry, Boss, for the forms for that issue close September 9."



*At the Hotel Stevens, Chicago, on September 19-21.

†And the same plan prevails at the convention of the American Railway Bridge and Building Association at the Hotel Stevens, Chicago, October 18-20.

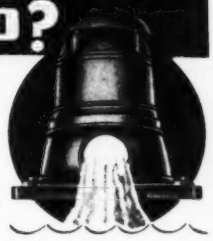
●

Railway Engineering and Maintenance Goes Every Month to 61 Supervisory Maintenance Officers of the Chicago, Rock Island & Pacific System at **4 General and District Offices, 10 Division Offices and 19 Other Supervisory Headquarters,** Scattered All the Way from Chicago to Goodland, Kan., Dalhart, Tex., and Ft. Worth. The Magazine Goes Also to 41 Other Subordinate Officers Who Are in Training for Promotion to Supervisory Positions on This System.

●

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS

How Many G.P.M. DO YOU NEED?



You can get all of the water you need, and at an amazingly low cost. The procedure is quite simple on your part. Just put the problem up to Layne. They, with their world-wide experience and years of outstanding success, will come prepared to study your needs and make definite recommendations on the type of wells and pumps best suited for you.

For nearly sixty years, Layne wells and pumps have met almost every conceivable water producing problem. They have met these problems with remarkably low operating cost and almost no upkeep expense.

AFFILIATED COMPANIES

LAYNE-ARKANSAS CO. STUTTGART, ARK.
LAYNE-ATLANTIC CO. . . . NORFOLK, VA.
LAYNE-CENTRAL CO. . . . MEMPHIS, TENN.
LAYNE-NORTHERN CO., MISHAWAKA, IND.
LAYNE-LOUISIANA CO. LAKE CHARLES, LA.
LAYNE-NEW YORK CO. . NEW YORK CITY AND PITTSBURGH . . . . . PA.
LAYNE-NORTHWEST CO. MILWAUKEE, WIS.
LAYNE-OHIO CO. . . . COLUMBUS, OHIO
LAYNE-TEXAS CO. . . . HOUSTON AND DALLAS . . . . . TEXAS
LAYNE-WESTERN CO., KANSAS CITY, MO. CHICAGO, ILL. . . . OMAHA, NEBRASKA
LAYNE-WESTERN CO. OF MINNESOTA MINNEAPOLIS . . . . . MINN.
LAYNE-BOWLER NEW ENGLAND COMPANY, BOSTON . . . . . MASSACHUSETTS.
INTERNATIONAL WATER SUPPLY, LTD., LONDON . . . . . ONTARIO, CANADA

All features of Layne wells and pumps are based upon proven engineering principles. That is why, when installed for you, they are most dependable for year in and year out high efficiency operation.

Our free bulletins will be mailed at your request. Address,

LAYNE & BOWLER, INC.
Dept. S, Memphis, Tenn.

LAYNE

PUMPS & WELL WATER SYSTEMS

For Municipalities, Industries, Railroads, Mines and Irrigation

A SOUND WAY TO SAVE On Track Maintenance

Promptly building up battered rail ends, grinding out rail corrugations and repairing frogs, switchpoints and crossings stop progressive damage that will run into real money.

Railway Track-work Model P-6 Track Grinder.

For savings and safety, keep up the rails. Railway Track-work Grinders are economical, long-life tools. There are many models to meet any requirement. Write for newest data bulletins.

See our exhibit, R. & M. of W. Convention spaces 86 and 87

Railway Track-work Co.

3132-48 East Thompson St., Philadelphia

WORLD'S HEADQUARTERS FOR TRACK GRINDERS

9420

SOMETHING NEW!!!

TECO Clamping Plate for Railroad Guard Rails

This pressed steel, enameled new flanged plate is particularly useful for clamping guard rails on trestles, and it is easy to install.

Place plates loosely under guard rail at each point where they are to be used. Scratch the marking on the guard rail, turn it over, drive the plates with a maul . . . then drop the whole section of guard rail over the ties and each TECO clamping plate is in correct position and firmly set.

Write for sample and prices

TIMBER ENGINEERING COMPANY
1337 Connecticut Ave., Washington, D. C.

Mall TRADE MARK

EQUIPMENT FOR RAILROADS

INCLUDES:

Rail Grinders
●
Cross Slotters
●
Rail Drills
●
Concrete Vibrators and Surfacers
●
Bridge and Building Machines
●
Gas and Electric Saws
●
Gas and Electric Drills
●
Power Wrenches
●
Flexible Shaft Grinders and Polishers
●

CATALOG ON REQUEST

MALL TOOL COMPANY
Railroad Department
7746 SOUTH CHICAGO AVENUE
Sales Offices in all principal cities Chicago, Illinois

BOOKS THAT HELP MAINTENANCE MEN

TRACK AND TURNOUT ENGINEERING

By C. M. KURTZ, *Engineer, Southern Pacific Company*

This new handbook for location, construction and maintenance of way engineers, transitmen and draftsmen, gives practical mathematical treatment of track layout and other problems. These are fully exemplified and worked out in detail, and illustrated with drawings of accepted designs for fixtures and track layouts. It contains original as well as a complete set of standard railway engineering handbook tables. All computing problems which may arise in track engineering are thoroughly treated.

457 pages, 116 illustrations, 33 tables, flexible binding, 5x7, $5.00

PRACTICAL TRACK WORK

By W. F. RENCH
Formerly Supervisor, Pennsylvania Railroad

A new book giving expert information on the design, fabrication and installation of standard railroad trackwork. Thoroughly describes switch stands, switches, frogs, crossings and slip switches.

256 pages, 110 illustrations, tables, flexible binding, 5x7, $1.50

ROADWAY AND TRACK

By W. F. RENCH

Packed full of practical information written on a background of 25 years experience. The meat of modern maintenance practice is in this book. It is the most complete work on the subject.

Second Edition, 226 pages, 44 illustrations, cloth, 6x9, $2.00

Simplified Curve and Switch Work

By W. F. RENCH, *Formerly Supervisor on the Pennsylvania*

This little book has practically revolutionized curve and switch calculation practice since its appearance 12 years ago. The proved accuracy of its methods has caused them to be adopted as standard practice on many roads.

Complex algebraic and geometric calculations are reduced to their simplest form and as nearly as possible to terms of simple arithmetic. Application of these calculations to the actual job is made plain by brief explanations. Drawings further clarify the subject and make the meaning of the text unmistakable. Tables of dimensions are a further help to the track foreman.

Short cut formulae are featured. String lining and tape line layouts are fully explained. While retaining practically all of the rules and principles which have been tested in previous editions, changes have been made in several detailed features to correspond to improved designs. A flexible binding makes the new edition more convenient to slip in the pocket and carry on the job.

Fourth Edition, 212 pages, 24 illustrations, 5x7, cloth, $2.00

SIMMONS-BOARDMAN PUBLISHING CORP.
30 Church St., New York.

Please send me for 10 days' free examination the books checked below. I will either remit list price or return the books within that time.

☐ Simplified Curve and Switch Work ☐ Practical Track Work
☐ Track and Turnout Engineering ☐ Roadway and Track

Name .....

Address .....

City ..... State: .....

Position ..... Company ..... RE&M 9-39

LUFKIN "HI-WAY"

The well-known Lufkin ease-of-use features and accuracy are perfectly combined with durability in the "Hi-Way." It actually outwears all other chain tapes. Prominent figures are cut into bright portions of the special, tough steel line for longer life and easier reading. See it at your dealers.

WRITE FOR CATALOG 12A

NEW YORK 106 Lafayette St. — THE LUFKIN RULE CO SAGINAW, MICHIGAN — Canadian Factory WINDSOR, ONT.

TAPES — RULES — PRECISION TOOLS

3½ Times Tougher!

Every Simplex Track Jack is Electrided—the exclusive process that hardens the gibs or rack bar slide and which increases their surface hardness to approximately 450 Brinell as compared to an average hardness of good malleable iron of 120 Brinell.

They're approximately 3½ times tougher, last many times longer than Jacks with ordinary malleable rack bar housing, and our sales of repair parts to the many railways of the United States and the world have been radically reduced.

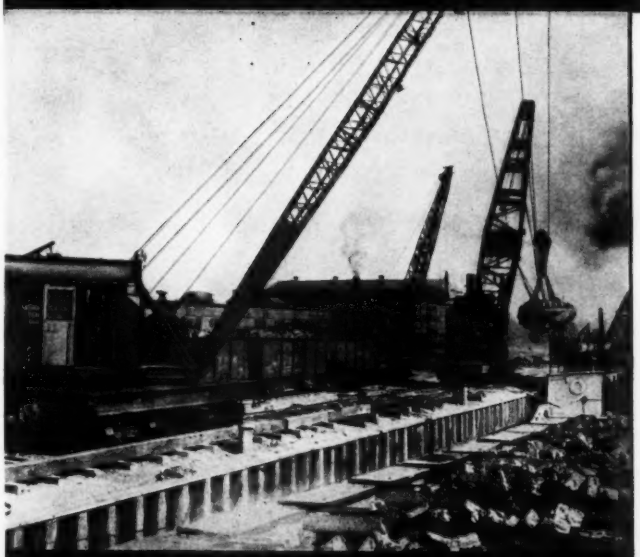
Have you the Simplex Railroad Jack bulletin? It covers Track Jacks, Rail Pullers and Expanders and G-Y Tie Spacers. Write for copy.

TEMPLETON, KENLY & CO.
Chicago, Ill.

Cutting Maintenance of Way Costs Since 1899
Representatives in Principal Cities of the World

SIMPLEX
GOLD MEDAL AWARD SAFETY JACKS

THE DIESEL CRANE IS OUT IN FRONT



INDUSTRIAL BROWNHOIST
GENERAL OFFICES: BAY CITY, MICHIGAN
DISTRICT OFFICES
New York, Philadelphia, Pittsburgh, Cleveland, Chicago

All over America today, Industrial Brownhoist Diesel cranes are replacing steam machines. The reasons why this is so should be of interest to everyone who handles materials.

With good grades of fuel oil available at low cost in most localities, the Industrial Brownhoist Diesel can effect a saving of at least 25% over existing handling costs. Furthermore, the Diesel crane is easier to operate and its two-speed travel and sustained power are a revelation to anyone whose work includes car switching. Last, but not least, the Industrial Brownhoist Diesel will have done an hour's work or more each morning while the steam crane is taking on coal and water and getting "steamed up".

Would it surprise you if an Industrial Brownhoist Diesel could pay for itself in two to three years on your work? We are confident that it would. May we help you compile the comparative figures?

JACKSON

UNIVERSAL TAMPERS

and the light, compact WS-4 Plant for

SPOTTING

with 2 or 4 Tampers

in any ballast—quickly—uniformly—firmly—at low cost

The WS-4 Power Plant in foreground operates 2 or 4 tampers for Spotting, surfacing, or similar operations with small gangs. Easily transported on a section car, this small, powerful unit weighs but 375 lbs. (actual lift at handles only 64 lbs.) and sets on a space 20" x 28".

Jackson "Universals" embody the experience of a quarter century in this field and have proved their superiority on this Country's leading roads in the following operations:

1. **Spot Tamping**
2. **Light Surfacing**
3. **New Ballast Insertion**
4. **Digging Ballast**
5. **Cleaning Ballast**
6. **Tie Renewals**
7. **Drainage Improvement**
8. **Grass Removal**
9. **Track Lowering**
10. **Skeletonizing**

Interchangeable on Jackson Universals are many versatile, time-tested blades, perfectly adapted to maintain track better, faster and cheaper.

Write for the manual — "Jackson Tampers — How To Use and Maintain Them" — and our new folders on Spot Tamping.

DEMONSTRATIONS? YES — NO OBLIGATION

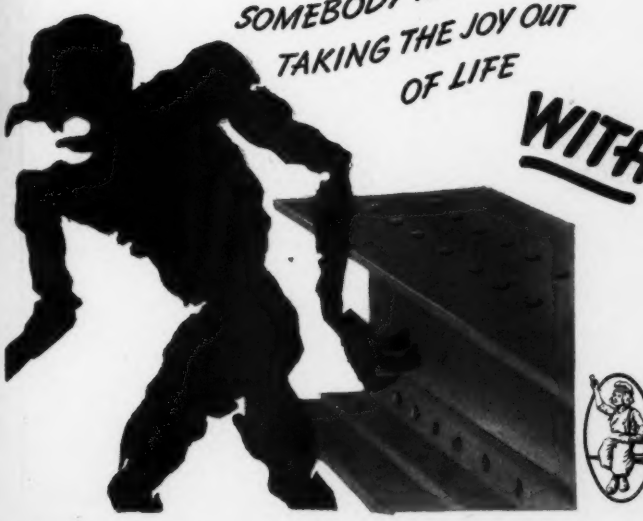
ELECTRIC TAMPER & EQUIPMENT CO., Ludington, Mich.

ALPHABETICAL INDEX TO ADVERTISERS

Air Reduction Sales Company....514
American Equipment Corp....512
Armco Railroad Sales Co....508
Barco Mfg. Company....506
Bethlehem Steel Company....545
Carnegie-Illinois Steel Corporation....509
Columbia Steel Company....509
Dearborn Chemical Company....505
Eaton Manufacturing Company....502
Electric Tamper & Equipment Co....552
Gary Screw and Bolt Company....512
Industrial Brownhoist....551
International Harvester Company, Inc....511
Koppers Company....507
Layne & Bowler, Inc....549
Lufkin Rule Co., The....551
Mall Tool Company....550
National Lead Company....553
Nordberg Mfg. Co....504
Oxweld Railroad Service Company, The....554
Pittsburgh Screw and Bolt Corporation....512
Rail Joint Company, Inc., The....501
Railroad Accessories Corporation....503
Railway Track-work Co....549
Reliance Spring Washer Division....502
Simmons-Boardman Publ. Corp....548-550
Templeton, Kenly & Co....551
Tennessee Coal, Iron & Railroad Company....509
Timber Engineering Company....550
Union Carbide and Carbon Corporation....554
United States Steel Corporation Subsidiary....509
Woolery Machine Company....547

THE FIRM OF RUST & CO. GOES BANKRUPT

FAMOUS WRECKING COMPANY FORCED TO SHUT DOWN



DUTCH BOY Red-Lead is a veteran rust-fighter. For years in the never-ending campaign to protect metal, this paint has been on duty in the front line. In practically every great American industry, you will find this paint guarding millions of square feet of metal surfaces. *So no one can be called an experimenter—or a chance taker—when he specifies Dutch Boy Red-Lead.*

First and foremost, this paint has "stick-to-itiveness." It takes hold and holds fast. At the same time, it is highly elastic—expansion or contraction of the metal surface does not loosen its grip. It not only keeps out moisture but also resists the destructive action of other common causes of corrosion—such as gases, smoke and salt water.

Dutch Boy Red-Lead comes in both paste and liquid form, the latter including a quick-drying type for use when allowable drying time is short. The pigment in every case is pure red-lead that contains more than 97% Pb_3O_4, thus assuring easier application, higher spreading rate and a uniform film of greater density. For long service, and complete dependability, specify

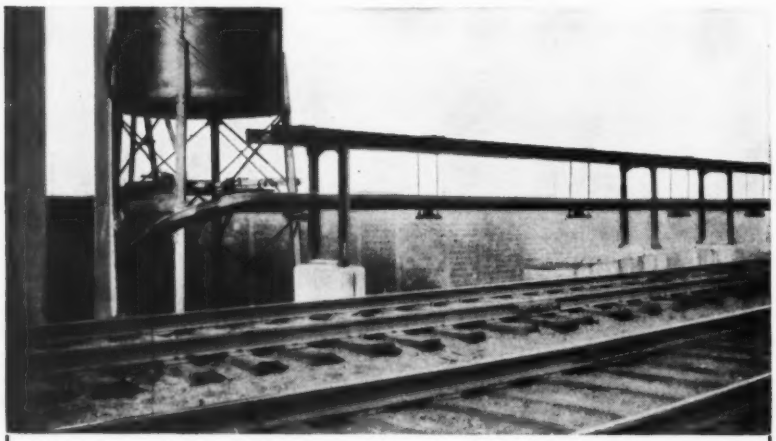
DUTCH BOY RED LEAD

NATIONAL LEAD COMPANY

111 Broadway, New York; 116 Oak St., Buffalo; 900 West 18th St., Chicago; 659 Freeman Ave., Cincinnati; 1213 West Third St., Cleveland; 722 Chestnut St., St. Louis; 2240 24th St., San Francisco; National-Boston Lead Co., 800 Albany St., Boston; National Lead & Oil Co. of Penna., 316 Fourth Ave., Pittsburgh; John T. Lewis & Bros. Co., Widener Building, Philadelphia.

Oxweld Railroad Service TOPICS

1912 — OVER A QUARTER CENTURY OF SERVICE TO AMERICAN RAILROADS — 1939



MANY ECONOMIES
with welded piping systems

Piping systems for all types of service—water, steam, gas, or oil—are installed at low cost by oxy-acetylene welding. Welded piping is easily insulated and offers minimum resistance to flow. Welding utilizes the full strength of the pipe and permits installation in cramped quarters or locations where space is a factor. The steam line illustrated was installed in a railroad yard over eleven years ago and is still in excellent condition—an example of the economical service obtained when piping is welded under Oxweld supervision.

AIR-ACETYLENE FLAME
aids in Building Maintenance

Air-acetylene appliances are widely used in building maintenance operations because of their instant heat and ready portability. The heavy-duty soldering iron is an effective tool in the installation and repair of gutters, leaders, and metal roofs. The air-acetylene torch is ideal for use when installing solder-type pipe fittings and for thawing frozen pipes because the flame is

confined to a small area. The paint burner provides a soft, easily controlled flame which speeds the removal of paint from wood or steel structures without damaging the base material.

• BRIEFS •

Motor Car Headlight—The Prest-O-Lite motor car headlight, weighing only 16½ pounds, is widely used as a portable light by track and bridge inspectors and water service men.

• • •

Hard-Facing Tamper Shoes—Experience has shown that the service life of tamper shoes can be increased 2 to 3 times by hard-facing a band of the wearing surface about one inch wide with Haynes Stellite alloy.

• • •

Wrinkle Bending—Wrinkle bending is a quick, low cost method of bending pipe to any desired curvature without reducing original wall thickness. As shown in the illustration, the wrinkles project outward so that full cross-sectional area is retained. Wrinkle bending is readily performed in conjunction with the installation of welded piping.

• • •

In addition to bringing to railroads the oxy-acetylene process applications described on this page, Oxweld Railroad Service provides hardening of rail ends, pressure welding of rail, rebuilding of rail ends, and Unionmelt welding. For further information on any of these operations, consult The Oxweld Railroad Service Company, Unit of Union Carbide and Carbon Corporation, Carbide and Carbon Building, Chicago and New York.

OXWELD RAILROAD SERVICE

The words "Haynes Stellite," "Oxweld," "Prest-O-Lite," and "Unionmelt" are registered trade-marks of Units of Union Carbide and Carbon Corporation